American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

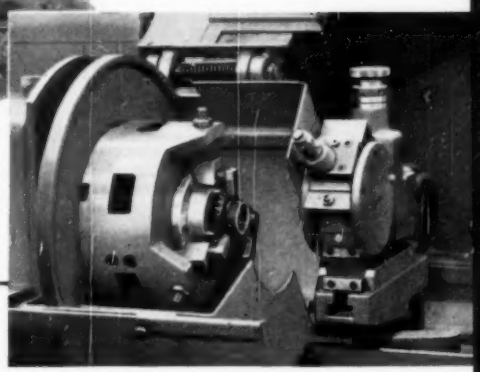
Assembling a stator frame *see page 2*

Heat-Treating Tractor Gears

Automatic Lathes—a special report

How to Bend Tube and Bar

how to pick a winner in the production race



Machines are like horses. To pick a winner, you've got to know something about their past performance.

Take two different makes of precision-finishing machines for example — both doing the same kind of job in *essentially the same way*. You might expect identical results, unless you knew that one particular machine had consistently outperformed all others in its class.

So, before you decide that your present machine is "still good enough"—or before you decide on a new one to replace it — be sure to check the record of Heald machines on similar jobs. And find out what a Heald machine can do for *your* particular application — in higher production and lower costs.

You'll find that, method for method, there's a *big difference* in machine performance.

Remember, when it comes to precision finishing, it pays to come to Heald.

Method-for-method this new Heald internal proved to be 50% better!

This Heald Model 271 Size-Matic Internal replaced an older model of a similar machine — doing the same kind of work in essentially the same way. Yet the new machine actually produced *50% more* parts per hour, with higher accuracy and precision throughout.

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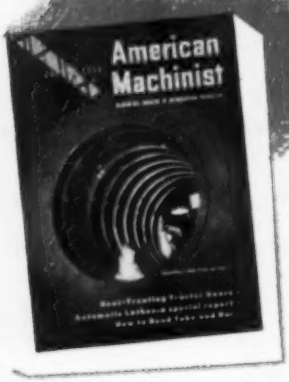

Chips and QUIPS

Stator . . . One of a series of large generator-stator frames, some weighing 150,000 lb and over 19 ft long, this unit is being fabricated at Lukens Steel Company, Coatesville, Pa. Formed and flame-cut steel plate, as much as 1 in. thick on the shell and 2¼ in. thick for cooler-box flanges, forms the assembly. Saddles along the sides supporting the frame are 4-in. formed plate. A number of these frames have been built for a large electrical manufacturer.

Automatics . . . For a couple of years, we have planned a Special Report on automatic lathes and screw machines, but have found it a complex subject to treat in any basic fashion. We now have taken a portion of the subject—automatic multi-spindle bar machines—which Associate Editor Rowan here puts into 16 fact-packed pages. That's twice what he expected to use, so you get an 8-page bonus. As a result of a series of visits to makers, plus the usual digging through reference material, he shows the operating principles of these machine tools and how they may be used in production.

Cooperative Production . . . Chris-Craft's new *Challenger* outboard engine is unique in being designed, then engineered for fast, economical production. Two factors helped—no deadline date, and a new plant to make it. Even so, the story of the approach to the problem is interesting, and Chester Ricker adds his graphic sketches . . . Ricker, incidentally, shows his versatility by having two articles in the same issue, the second covering close-tolerance production of diesel-injector bodies at Cummins Engine.

Heat-Treating Costs . . . Roy F. Kern, metallurgist at the Springfield (Ill.) plant of Allis-Chalmers, describes how to cut heat-treating costs on crawler-tractor and motor-grader gears. The solution there was a new department, scientifically laid out, sound metallurgical control, and planned preventive maintenance. Here are sound bits of advice for solving your heat-treating problems.

Shorts . . . As usual, ideas that can be explained quickly are handled to save your time . . . There's a page that tells about Bill and his informal management—the envy of the nearby big plant . . . Another page shows standard units lined up at Nordberg to ream chain links . . . A spread of pictures shows a half-dozen interesting operations at Dictaphone Corporation.

Bending . . . Almost a year ago, we began working with H. M. Williams on the idea of an article on tube and bar bending, based upon his years of experience, in this field (see biog.). At long last we bring it to you herewith, and picture Mr. Williams (below).

Upside Down . . . A pair of scientists recently startled a lathe maker by asking, without preamble: "Can this machine be operated upside down?" Said the sales manager: "We can bolt a couple of parts down now held by gravity and it will work O.K. Why?" Turned out they were atomic scientists, wanted a lathe and a miller to be operated by remote control on radioactive materials in a leadlined room. If the machine could be operated upside down, any radioactive chips could be caught in a box below, so they wouldn't touch, and thus activate, the tool. That's two machines that won't appear in surplus.

The same company had its new models, on their way back from the ASTE Show, in a boxcar which overturned. As some units were prototypes, executives worried. Turned out the packing was so good the units were unharmed.

Coming . . . Aug. 7 *AM* will include a further report on high-speed machining, a description of Packard's trial & test group, an article on repairing forging dies by welding, sketches of typical compound stamping dies, a new method of burring gears, and several shorts. There'll also be a report of our survey on productivity of machine tools. The cover will picture some attractive gaging.

BAR BENDER . . . **H. M. Williams, a native of Moline, Ill., attended only country schools. At 16, he began a 3-year apprenticeship in a general repair shop and foundry, specializing in steam-engine and pump repairs. He was machine engineer asst. to the v.p. and works manager of Pullman Car & Mfg. Co., Chicago, from 1923 to 1927; sales engineer for Beatty Machine & Mfg. Co., Hammond, Ind., for the next two years; then for Williams White & Co., Moline, Ill., for 5½ years.**

During this latter period, he specialized in standard and high-speed special tube and bar bending equipment. After four years of similar work with Kane & Roach, Inc., Syracuse, N. Y., he became on Sept. 1, 1948, chief engineer of the Fabricating Equipt Div. of Acme-Wintor Corp., Buffalo. When the latter company closed, he moved to a similar job at General Riveters, Inc., Buffalo. Much of this experience is distilled into his current article.

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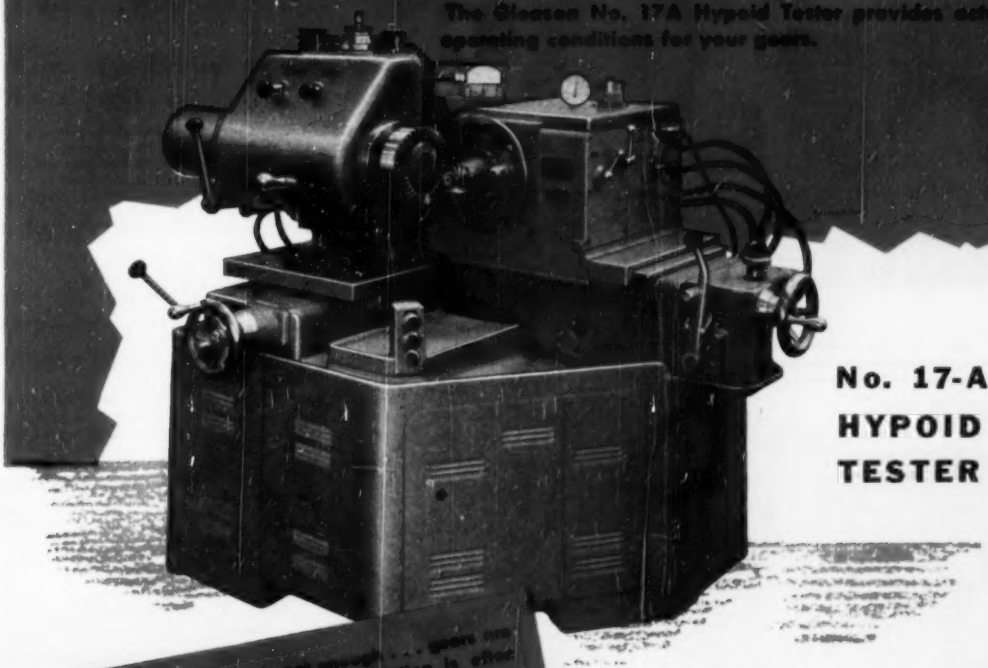

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Just cutting bevel gears is not enough . . . gears are used in units where uninterrupted operation is often essential. They have to operate under extreme loads at top speeds with accurate transmission of power. Just how these gears are being cut, the uniformity with which they are being manufactured and how they will best operate when assembled can be easily determined. For the No. 17A Hypoid Tester can be simply set up and a constant check can easily be made to guarantee top quality results . . . Results, for longer lasting smoother operating bevel gears.

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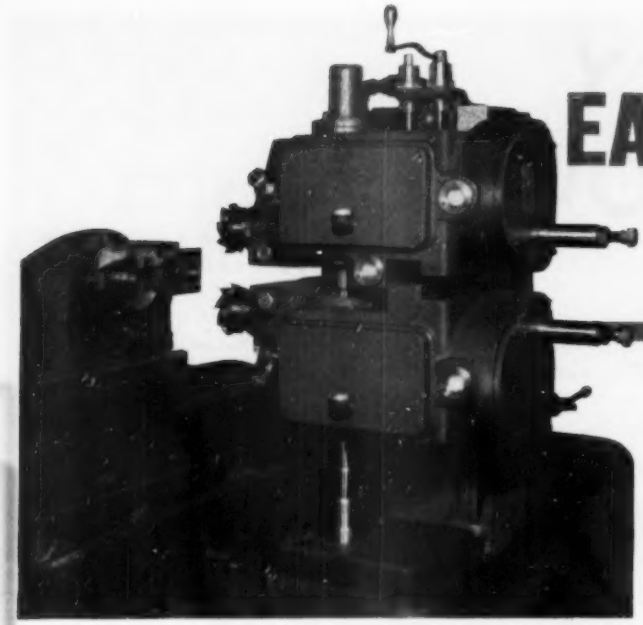
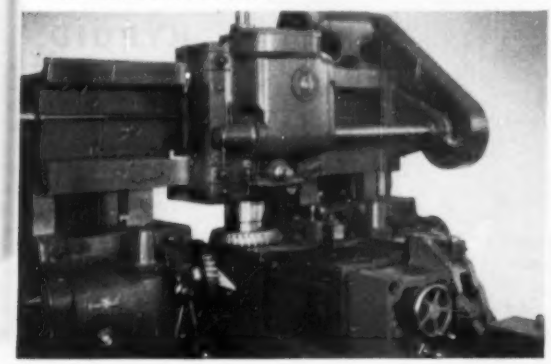
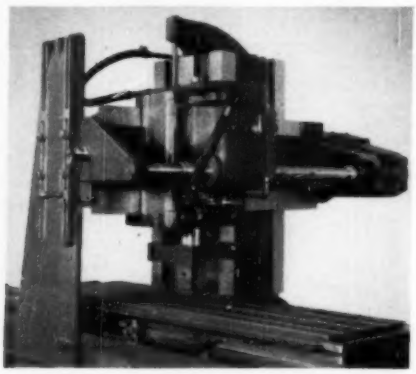


Close-coupled spindle carriers, left, replace the standard spindle carrier on a No. 34-36 Plain Hydromatic. In one pass two opposite slots are milled in aluminum pistons at a rate of 41 per hour.

Below: Vertical spindle carrier on a **fixed height rail** applied to a No. 45-60 Duplex Hydromatic. This equipment mills the top, bottom, and pad on cylinder blocks.



Below: Vertical spindle carrier on a **variable height rail** with outboard support, converts this No. 46-72 Hydromatic into a general-purpose, automatic cycle vertical milling machine for large work.



Increased cross range accommodates extra large work. The No. 56-90 Duplex Hydromatic illustrated here measures 70" max. between spindle noses.

CIN

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Take a look at the heavy duty automatic milling machines in your shop which may have become productively obsolete. You may be surprised to see how much you could gain—in production and lower unit cost—by replacing with CINCINNATI Hydromatics, built up with pre-fab units to suit the job. They offer many cost-cutting replacement possibilities. May we send you a copy of the new, fully illustrated catalog?

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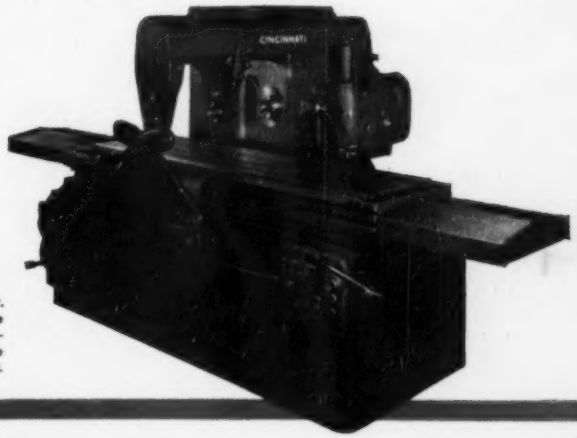

Standard CINCINNATI No. 5-60 Plain Hydromatic Miller. Duplex style also available; 18 sizes of each. These machines can be changed to suit the job by the addition or substitution of many pre-fab units. Complete data may be obtained by writing for catalog No. M-1670.

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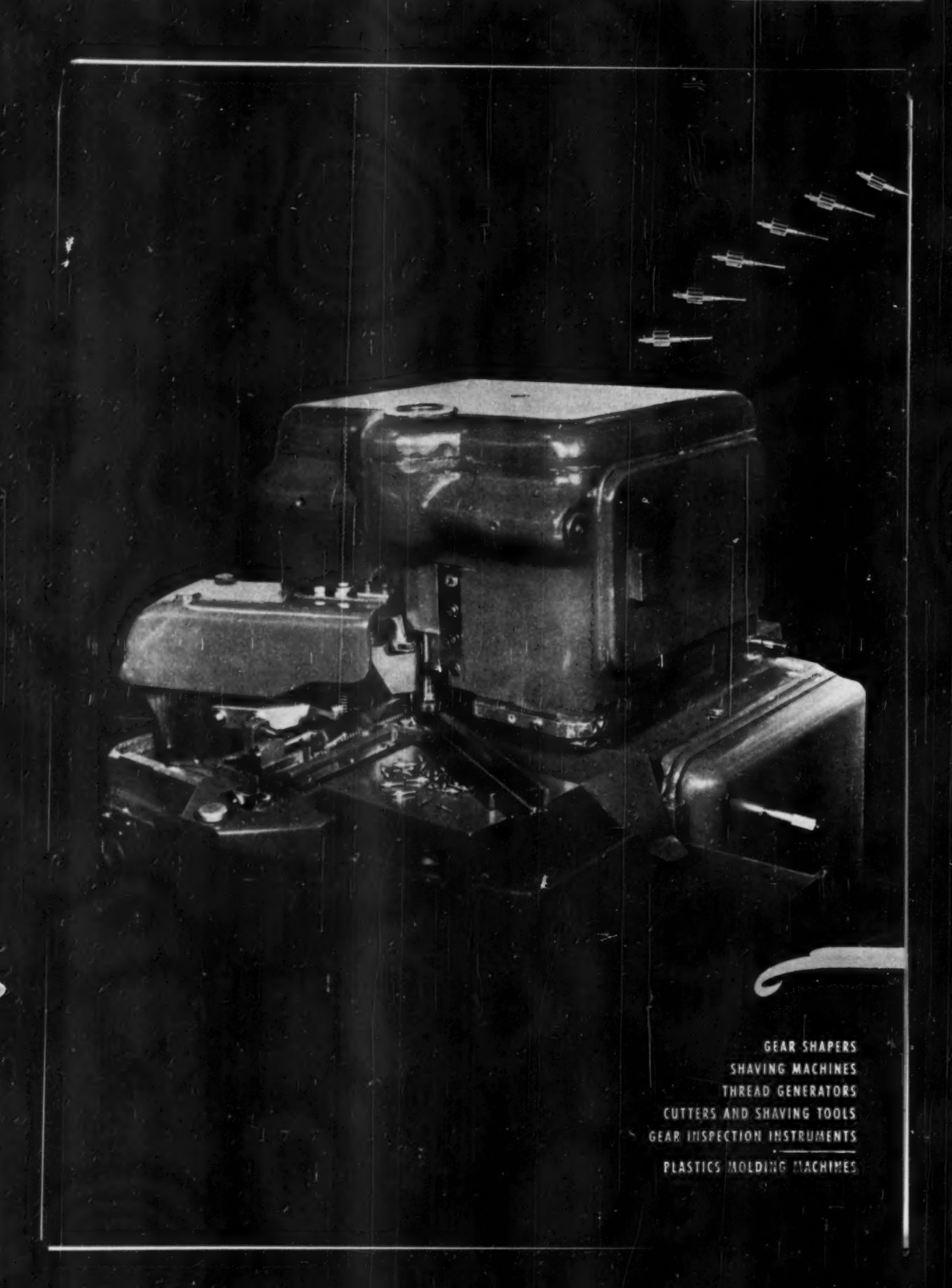

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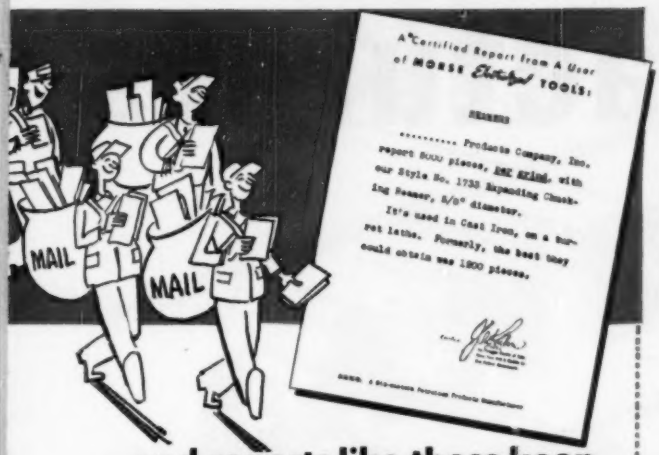
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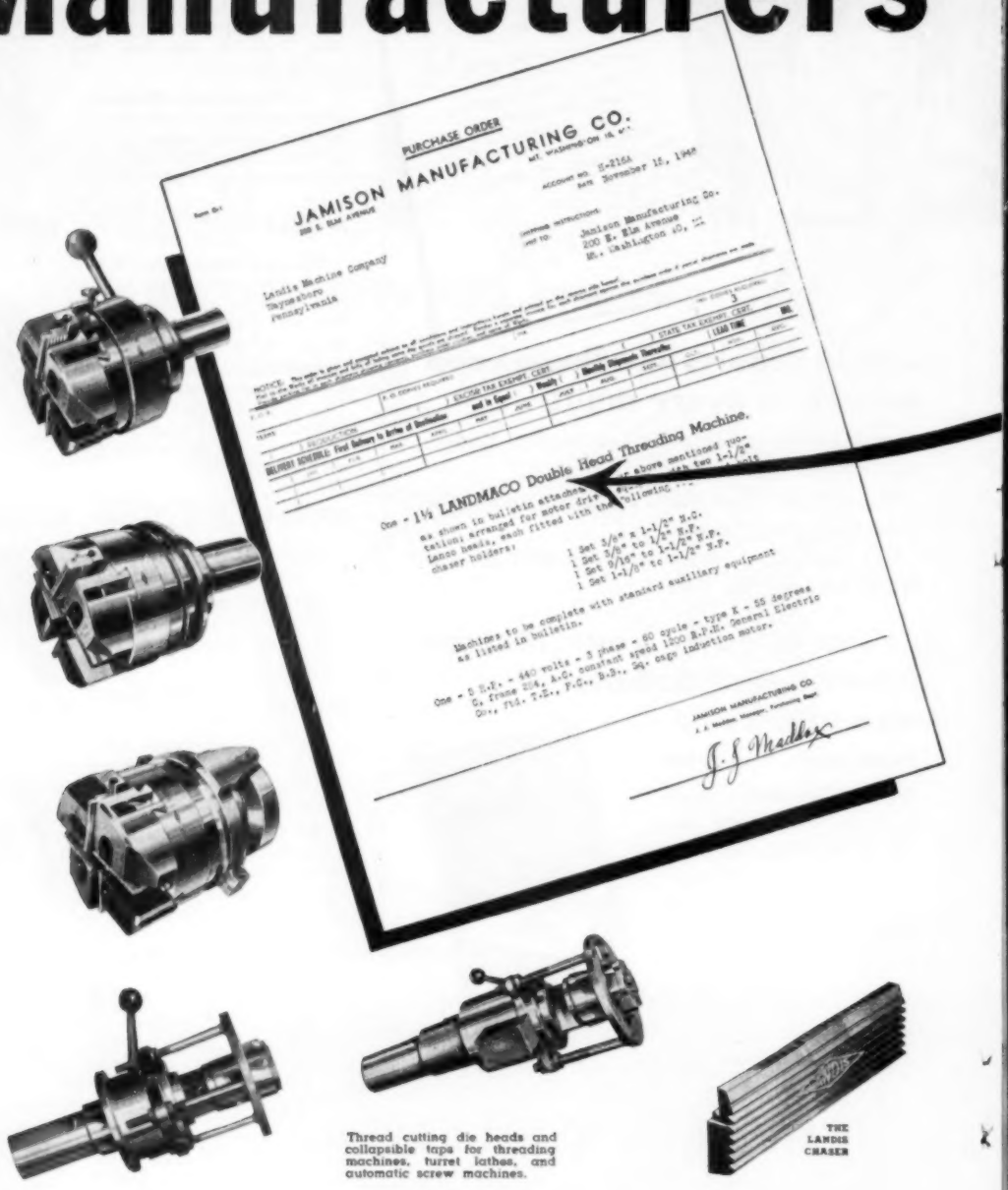
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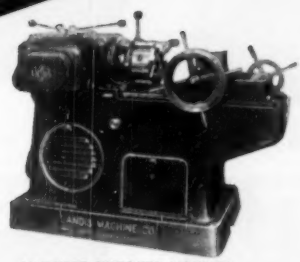

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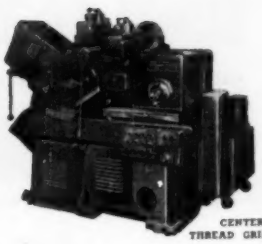

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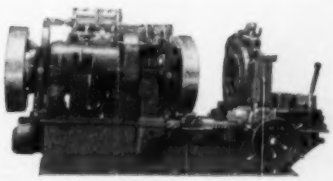
AUTOMATIC NIPPLE MACHINE

SEMI-AUTOMATIC THREADER



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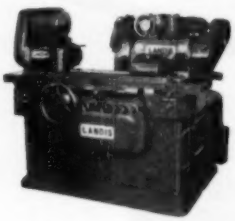
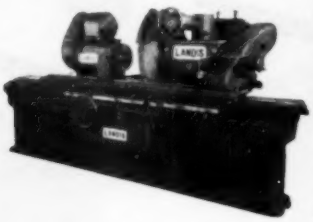


6" Type CH Plain



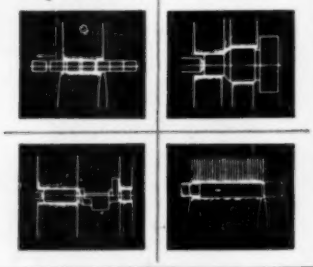
10" Type CH Plain

CENTERLESS HIGH PRODUCTION GRINDER

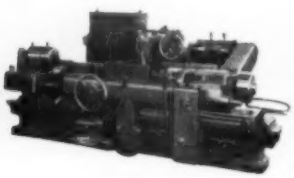
No. 12 Centerless

Centerless Thread Grinder

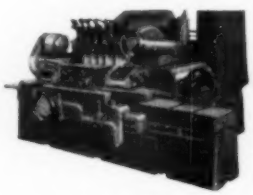
operation sketches



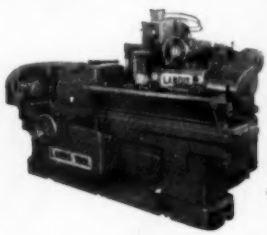
SPECIAL PURPOSE GRINDERS



Crank Pin



Multiple Wheel



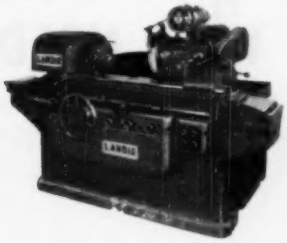
Cam Contour

engineered grinding service

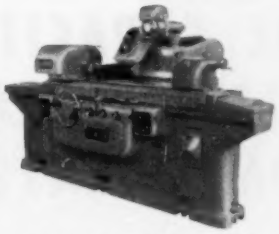
LANDIS TOOL precision grinders are easily modified for special jobs. Typical examples of these modifications are raised work centers so that work with large projections may be ground, angle wheelbases for grinding outside diameters and faces in one operation and special operating cycles for maximum production of specialized work pieces. On the basis of your blueprints, our engineers will give you production estimates and tooling recommendations.

Cylindrical Grinding needs

HEAVY STOCK REMOVAL
HIGH PRODUCTION
COST REDUCTION
FINE FINISH
CLOSE TOLERANCE

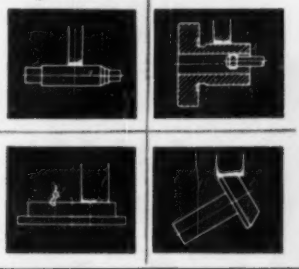


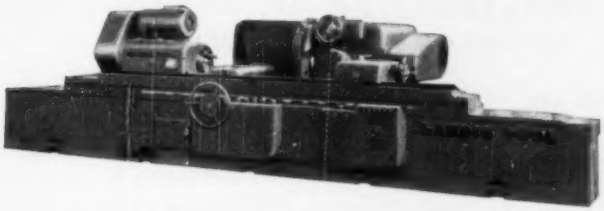
10"x 24" Type CH Universal



12" Type CH, 14"-18" Type C Universal

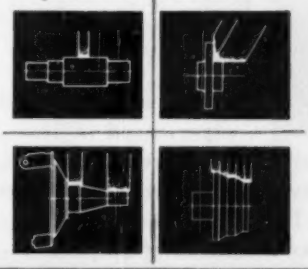
operation sketches





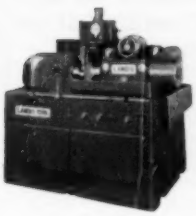
Type F Plain

operation sketches



LANDIS TOOL
Precision Grinders

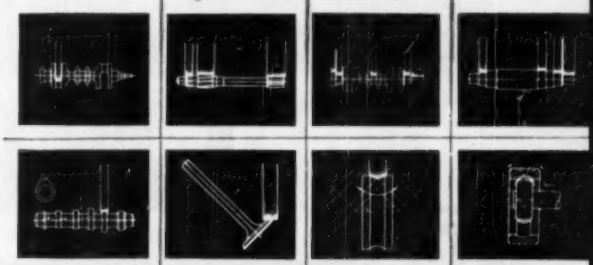
LANDIS TOOL COMPANY • Waynesboro, Penna., U. S. A.



Valve Face

Ball Race

operation sketches



optional features available

Automatic cycles
Loading fixtures
Work holding fixtures
Wheel base mounted wheel dressers
Hydraulic rapid infeed
Rapid wheel positioning
Automatic sizing
Profile wheel dressers

EQUIPPED WITH MICROSPHERE BEARINGS

microsphere bearing
equipped for accuracy

FOR BOTH *Manufacture*

HERE'S THE CAPACITY YOU NEED TO COMPLETELY MACHINE DIESEL COMPONENTS

G. & L. ***FLEXIBILITY*** **PERMITS MACHINING DIFFICULT-TO-REACH SURFACES**

OPEN CONSTRUCTION **SPEEDS HANDLING OF HEAVY, BULKY WORK**

Fewer machining difficulties are experienced in both manufacture and repair of diesel engine parts when the work is performed on the versatile Giddings & Lewis horizontal boring machine. The user is assured of ample capacity to handle all sizes and types of work. The diesel part may extend in any plane, for there are no interfering columns or supports to limit work size. Once the part is correctly set up, a wide variety of milling, drilling, boring, reaming, facing, backfacing, and similar operations are easily performed.

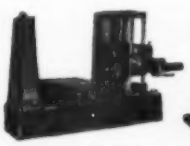
Flexibility of the Giddings & Lewis machine makes it a simple matter to raise, lower or extend the spindle to reach surfaces which would be inaccessible on other equipment. In addition, this same flexibility permits greater latitude in engine designing.

REPAIRING and REBUILDING DIESELS

An example of one of the most common repairs made on a diesel is reboring the main bearings. This is an easy operation for a G. & L. machine. In the manufacture of an engine, main bearings are bored using some type of supporting fixture.

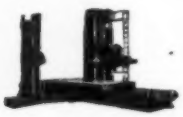
When repairing and reboring one, two, three or even more damaged bearings, a fixture is not required. The good bearing closest the one to be rebored is bushed to receive and support the bar. After the operation is completed, the new bore is then bushed and it in turn supports the bar.

Factory repair and rebuilding operations on different diesels may be simulated in any shop equipped with a Giddings & Lewis horizontal boring machine. G. & L. engineers will be glad to recommend the machine best suited to your need. Call on them now — there is no obligation.



G. & L. Table Type

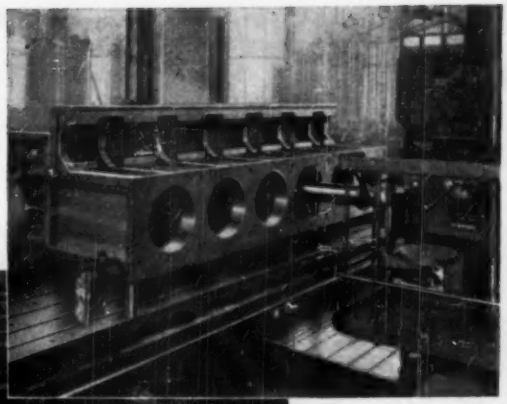
G. & L. Floor Type



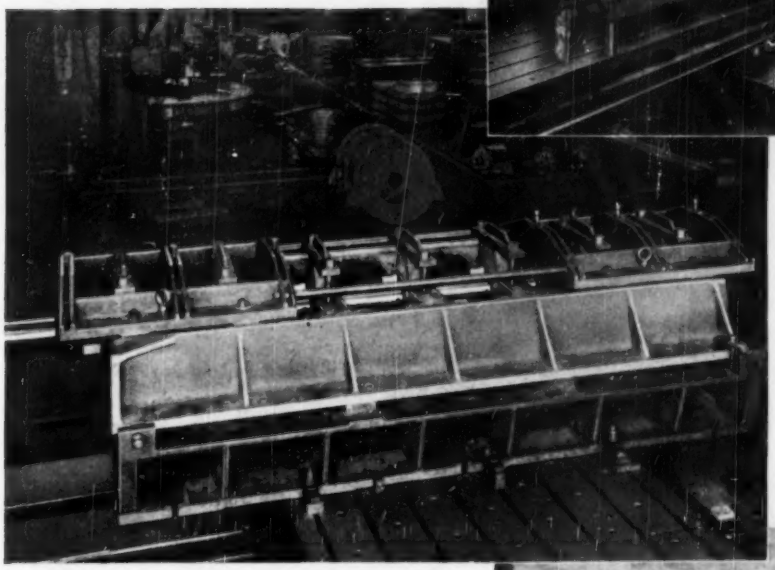
G. & L. Planer Type

GIDDINGS & LEWIS
FOND DU LAC

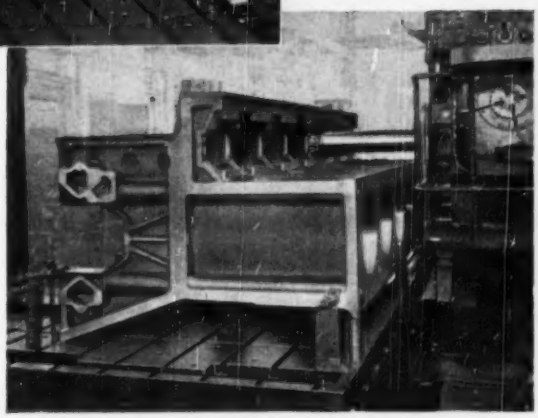
AND *Repair*



Machine scales and verniers are used to establish hole centers on this six cylinder block. Cylinder liners will be used after boring operations are completed.



Boring seven main bearings simultaneously. Internal bar support fixture is used as shown in this manufacturing operation. To repair and rebore bearings the fixture is not used. Undamaged bearings are bushed to support and align the bar.



Difficult-to-reach surfaces such as this camshaft bearing saddle are easily milled by extending the machine spindle as shown.

Helpful Production Facts **FREE**

Write today for applicable data covering standard and special machining problems. Actual field stories show how difficult jobs are handled. Ask for Production Data Bulletin No. 267

MACHINE TOOL COMPANY

WISCONSIN U. S. A.

wherever you are...

ALEMITE OFFERS LOCAL SERVICE & SUPPLY

Over 1700 Alemite Service and Supply Centers Assure You Quick, Efficient Service—On the Spot!

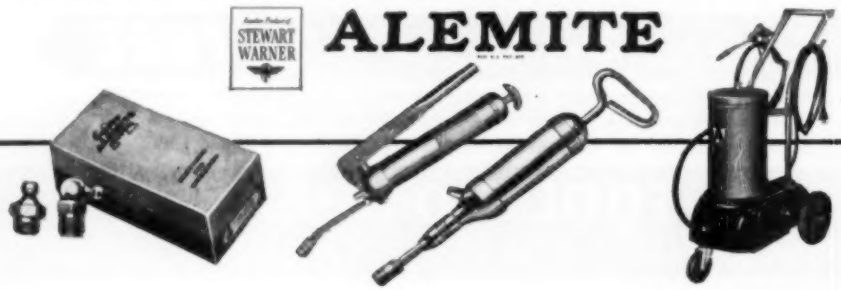
That's why Alemite customers from coast to coast save time, trouble and money—*daily!* They depend and call upon this vast, national network of experienced lubrication specialists. And so can you!

Every Alemite Service Center is staffed by qualified personnel, ready to offer experienced counsel and rapid aid on any lubrication problem you face. Fast, on-the-spot service is a *habit*, not an occasion, with these local Alemite branches, distributors and service jobbers. They are equally "at home" with maintenance, repair or supply problems. And they know what "hurry" means!

Write today for the name and address of your nearest Alemite representative. Address your proposal to Alemite, Dept. D-70, 1850 Diversey Parkway, Chicago 14, Illinois.

Another Product of STEWART WARNER

ALEMITE



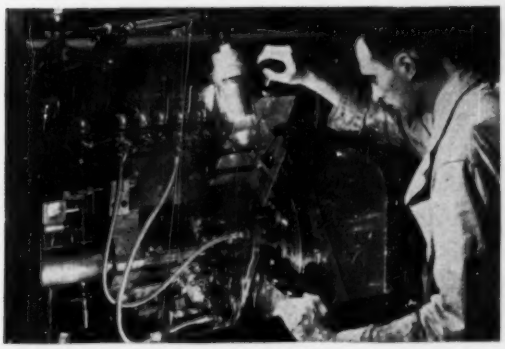
SOMEONE IS INVESTING MONEY RIGHT NOW TO CUT MANUFACTURING COSTS

It may be your competitor!

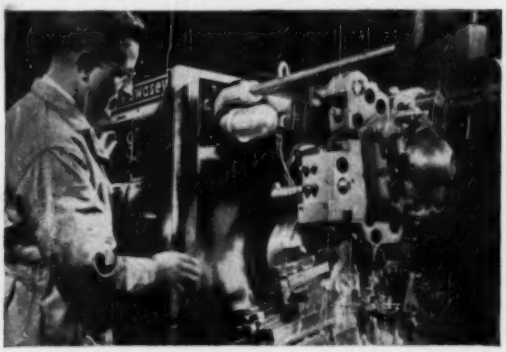
When any one of your competitors invests in new machinery to increase output and cut his manufacturing costs, your profit outlook grows darker. Unless your production costs are at rock bottom he can undersell you, take orders away from you—and do it profitably!

Don't invite lost orders by standing pat with old equipment. A replacement program for your shop can result in savings like those shown by actual experience in machine shops all over the country.

COMPANY A replaced two old turret lathes with *one* new Warner & Swasey No. 4 Universal. Output went up over 100%. Savings of over $3,400 a year were realized.



COMPANY B invested $130,000 in new Warner & Swasey 5-Spindle Automatics. Savings—$90,000 a year on the cost of the screw machine products the company uses.



COMPANY C invested in a new Warner & Swasey Single Spindle Automatic for the roughing of gear blanks. Production went up over 200%!

If you would like results like these, call in your nearest Warner & Swasey representative. He'll make a thorough, sound analysis—show you how, by replacing old machine tools, you can cut manufacturing costs . . . increase output . . . make a greater profit on your investment.

WARNER & SWASEY SELLS ONE THING . . . INCREASED PRODUCTION

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE AND SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

It Cuts . . It Smooths . .
NORTON
Reinforced
HUB WHEEL
AND IT NOTCHES, TOO
The quick economical way to remove gates and risers from castings is to notch with this new Norton wheel and then knock off with a sledge.

Now you can Cut, Rough Grind and Finish Grind with the Same Wheel!

STRONGER and SAFER

Comparison will convince you that the new NORTON REINFORCED Hub Wheel is a stronger, safer wheel for use on your right-angle portable grinders and sanders. Layers of strong, fibrous material, plus a special safety web molded into the back of each wheel, prevent it from flying apart in use even though accidental breakage should occur.

FASTER CUTTING

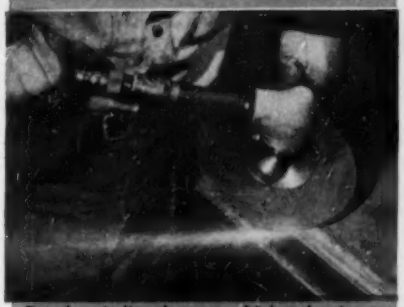
Comparison will convince you that this new Norton wheel cuts as fast, and often faster than other wheels of similar type. It cuts fast and clean without spalling and loading, because it contains sharp, durable ALUNDUM abrasive, a special resinoid bond and has a unique file-like cutting surface.

LONGER LIFE

Comparison will convince you that you get longer, more economical life with a NORTON REINFORCED Hub Wheel — the strongest, most durable wheel of its type on the market. Many plants have discovered that this wheel lasts two to three times longer than wheels used previously.

VERSATILE

And comparison will prove to you that this wheel is really versatile. Now you can rough and finish grind with the same wheel — ***and you can notch with it too!***



Rough grinding heavy weld bead prior to finish grinding with same wheel.

Notching risers on ferrous casting prior to knocking off with sledge.

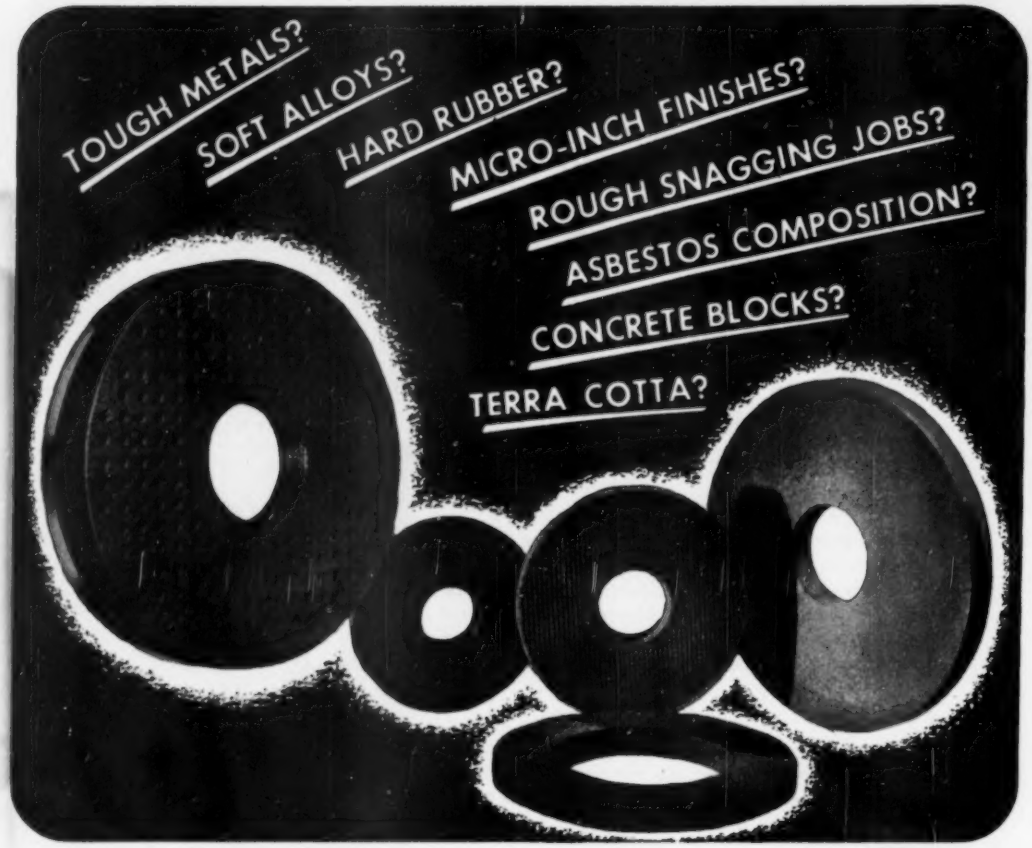
Smoothing surface of large brass casting. Note how easily wheel gets into corner.

NORTON ABRASIVES

Make the comparison in your shop. Contact your Norton abrasive engineer or distributor for full details, or write for your free copy of the folder on "NORTON REINFORCED Hub Wheels".

W-1288

There's a GARDNER WIRE-LOKT ABRASIVE DISC OR WHEEL *best suited for your grinding job*



WHETHER you grind tough metals, soft alloys, hard rubber, asbestos compositions, terra cotta, or concrete blocks

— whether your work requires rough snagging operations, or micro-inch finishes

— no matter WHAT sort of jobs you're handling on your Disc Grinders, there's a GARDNER Abrasive Wheel to solve YOUR problem!

Yes, Gardner WIRE-LOKT Wheels are built in the EXACT type, bond, grade, and grain to meet your every need. And eighteen direct representatives, plus some sixteen dealers, afford country-wide coverage — bring a man to your plant, right when you need him most!

WRITE FOR YOUR COPY OF THIS BOOKLET

GARDNER MACHINE COMPANY

410 EAST GARDNER STREET . . . . BELOIT, WISCONSIN, U.S.A.

One hour

1800 lbs.-rough

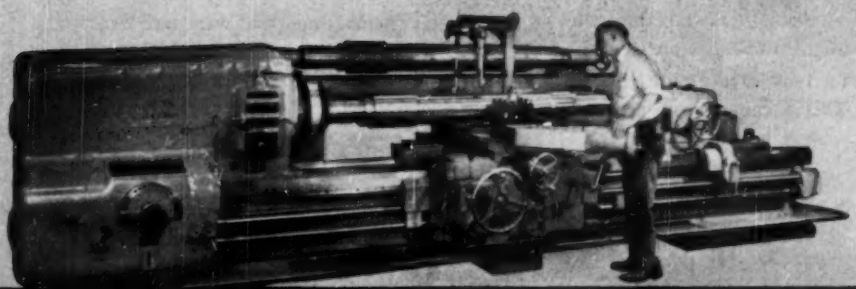
1300 lbs.-finished

One hour to finish turn this Diesel Locomotive Driving Axle from the rough forging, removing 500 pounds of chips and using 60 horse power cuts in the process.

This shows what a 25" "AMERICAN" Hydraulic Duplicating Lathe driven by a 50 H.P. motor can do. Production records of this kind are the rule rather than the exception and are being made daily.

"AMERICAN" Hydraulic Duplicating Lathes reduce machining time 50 to 75 per cent . . . cut costs to the bone . . . pay good dividends on the investment.

Repeat customers vouch for this in the most convincing way.



Bulletin No. 35 gives a complete description and shows many examples. It's yours for the asking.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

. . . it won't cost to inquire!

YOU MIGHT FACE THIS TRIPLE PROBLEM. A manufacturer of fuel injection nozzles had to traverse grind a .2363 inch bore with a seven to one ratio of diameter to length. At the bottom of this bore, a taper seat had to be traverse ground to an angular tolerance of one minute. Below the taper seat, a .0394 inch bore had to be traverse ground. All three surfaces had to be concentric within one-tenth.

The Bryant No. 1309-W does the job in a single chucking. This machine can do precision work because of such outstanding features as pre-loaded ball bearing slides for rigidity; an auxiliary angular slide for traverse grinding the taper seat; Bryant Hi-frequency wheelheads for speeds up to 100,000 R.P.M., and a precision work-head which indexes from one wheel to the other to maintain concentricity.

Progressive management will want such facts translated into the investment return which they can expect by improving accuracy and production on their own work. It won't cost to inquire.

May we arrange a showing of a 16 mm sound and color film on the No. 1309-W and other Bryant grinders?

BRYANT

CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U.S.A.

AN OIL PAN EVERY Ten Seconds!

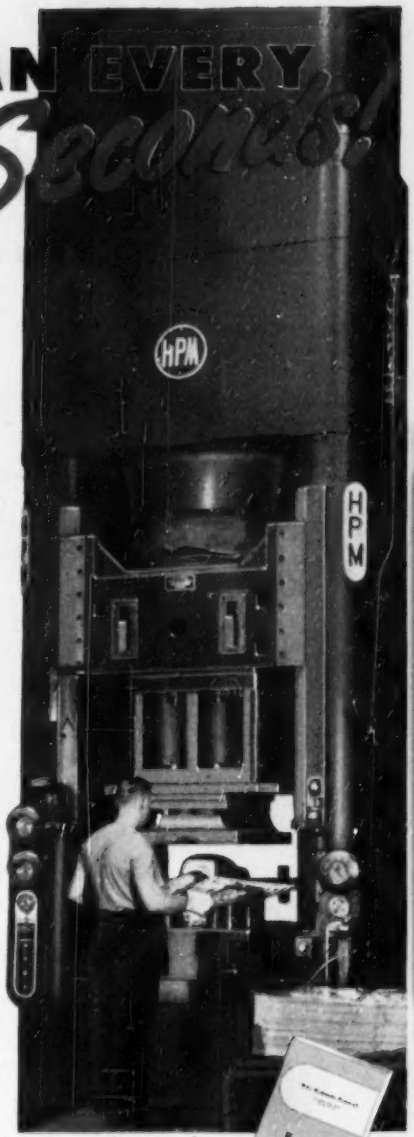
Another H-P-M production record with less than 1% scrap!

Things really began to "pop" when a prominent mid-western stamping company installed a 750-ton H-P-M deep drawing press. Here's their story on the production of automotive oil pans.

—**350 oil pans per hour!**
—**Scrap loss was cut from 3½ to less than 1%!**
—**Drawing operations were reduced on one job from 2 to 1!**

This H-P-M press owner is also "going to town" on many new production opportunities opened up by this versatile H-P-M hydraulic! A typical job is a tank drawn from ¼" thick steel stock.

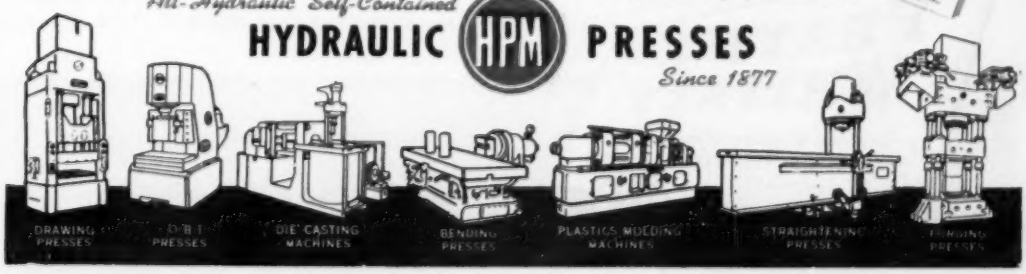
This is not the only plant where H-P-M hydraulics have done a real job. H-P-M's constant drawing speed . . . smooth, fast operation . . . shockless reversal . . . positive overload protection . . . quick die set-up make it possible to put your toughest metal working jobs in the profit column. Call in a nearby H-P-M engineer to analyze your specific parts production. We may be able to save you real money! There's no obligation. Write today!



Write for your free copy of TOOL & DIE JOURNAL'S informative article, "Why Hydraulic Presses"

THE HYDRAULIC PRESS MFG. COMPANY
1002 Marion Road Mount Gilead, Ohio, U.S.A.

All-Hydraulic Self-Contained
HYDRAULIC HPM PRESSES
Since 1877



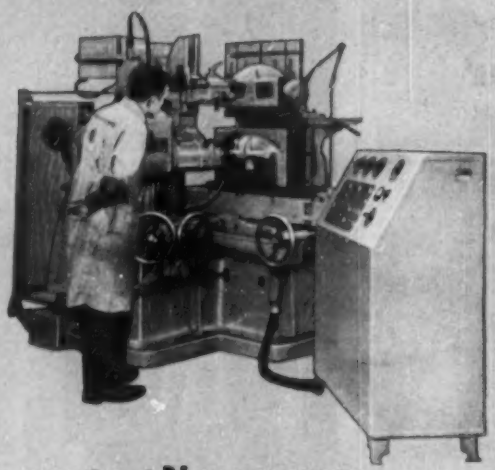
KELLERING

WITH THE *NEW* PRATT & WHITNEY *BL* KELLER MACHINE

at high speeds . . . brings greater profits

NEW FEATURES

make the new Keller Machine extremely fast for reproducing exact contours from any master form



THE 24" x 16" *BL* KELLER MACHINE

— new, speedy automatic tracer operating in conjunction with newly designed electrical circuits.

— new, increased range of travel rates, from .5" to 30" per minute, conveniently controlled by operator from his normal working position.

— new, automatic speed control provides continuous variation of individual machine motions in proportion to the slope of the shape being traced, with the tracer gliding smoothly over any contour 2 or 3 times faster, regardless of shape.

— new and greater selectivity of the most suitable feed for any job by means of newly designed single-unit feed contactor, with feed range from .010" to 4" in steps of .010".

— new electrical design permits direct connection to any conventional 50 or 60 cycle polyphase power supply.

A set of fan blade dies machined on the *BL* KELLER, typical of the precision work produced at new speeds — new profits.

LOOK into it — the new *BL* KELLER (24" x 16" and 36" x 20") gives you a competitive advantage you cannot afford to overlook when it comes to the accurate duplication of templates and models by automatic, tracer-controlled milling in the production of dies, molds, patterns, prototypes, short-run parts — 2 dimensional and 3 dimensional. Its new speed substantially reduces actual machine hours, a performance factor of tremendous profit potential. Bulletin gives all the facts; ask for it.

PRATT & WHITNEY

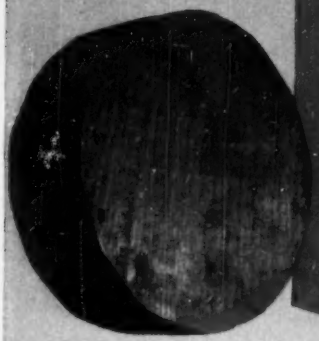
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

MACHINE TOOLS • CUTTING TOOLS • GAGES

90th Year

SYMBOL OF ACCURACY SINCE 1860

MACHINING CUT-OFF BAR STOCK WITH . . .



Regular Production
TOOLING ON THE POTTER & JOHNSTON 5D AUTOMATIC

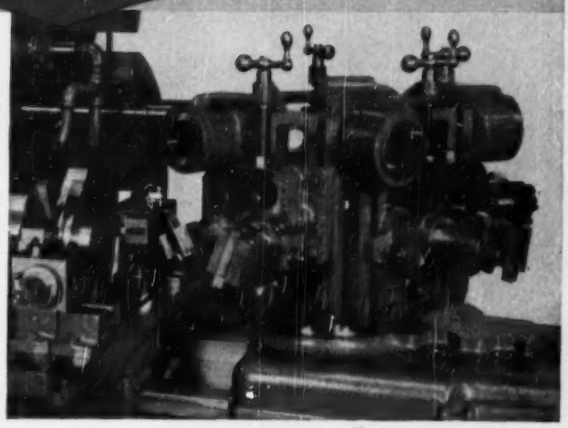
. . . PRODUCES PRECISION WORK LIKE THIS IN A GREAT VARIETY OF SIZES

PROBLEM — To manufacture a general line of sprockets within precision limits, in a wide range of sizes, on a quantity basis, with the greatest economy.

SOLUTION — The P&J 5D Powerflex AUTOMATIC, tooled with P&J solid and adjustable Tool Holders . . . Turning Stems of the solid and micrometer types . . . Turret Bushings for boring bars . . . Boring Bar Holders . . . and Cross Slide Blocks. All of these Tools are regular production tools, designed by P&J to work most effectively in conjunction with the automatically controlled movements of the Turret and Cross Slide.

Twenty-one drilling, boring, turning and facing cuts with regular P&J Tools, and two grooving cuts with one form tool, complete the sprocket in two high speed operations.

RESULT — Economy in tooling . . . economy in upkeep . . . economy in work handling . . . economy in labor costs, with one operator easily handling two machines.



SUGGESTION — Is *your* Tooling engineered for maximum economy? Get a P&J Tooling Recommendation and a detailed report on this P&J Time Estimate Sheet — then compare. Send sample parts or prints.

P&J 50 YEARS' EXPERIENCE IN TOOLING FOR
Precision + Productivity + Economy

POTTER & JOHNSTON CO.
PAWTUCKET, R. I.
subsidiary of PRATT & WHITNEY
Division Niles-Bement-Pond Company

A better way
BEHR-MANNING
BEHR
USE NORTON

to solve your grinding and polishing problems

Use the Behr-Manning Demonstration Shop near you

Solve your finishing problems in a hurry—without plant interruption—without days wasted. Your local BEHR-MANNING Demonstration Shop has the latest equipment and is staffed with Field Engineers ready to apply the latest methods. Toss your toughest problems at us . . . or any routine job, for that matter. We'll run pieces through for comparison with your own finished parts. And we'll show you why BEHR-MANNING Belts, Discs and other abrasive products cut finishing costs and raise output. Take advantage of this service. It's yours for the asking.

GET THE FULL STORY . . . SEND THIS COUPON NOW

See how you can use your local BEHR-MANNING Demonstration Shop to advantage. The whole story is in the new bulletin. Send for your free copy today.

BEHR-MANNING
Demonstration Shops are

all over the map . . .

Boston	Indianapolis
Buffalo	Los Angeles
Chicago	New York
Cincinnati	Philadelphia
Cleveland	St. Louis
Detroit	San Francisco
Grand Rapids	Seattle
High Point	Troy

BEHR-MANNING, TROY, N. Y., DEPT. AM 7-50
Please send me a copy of "Proving Ground For Production"

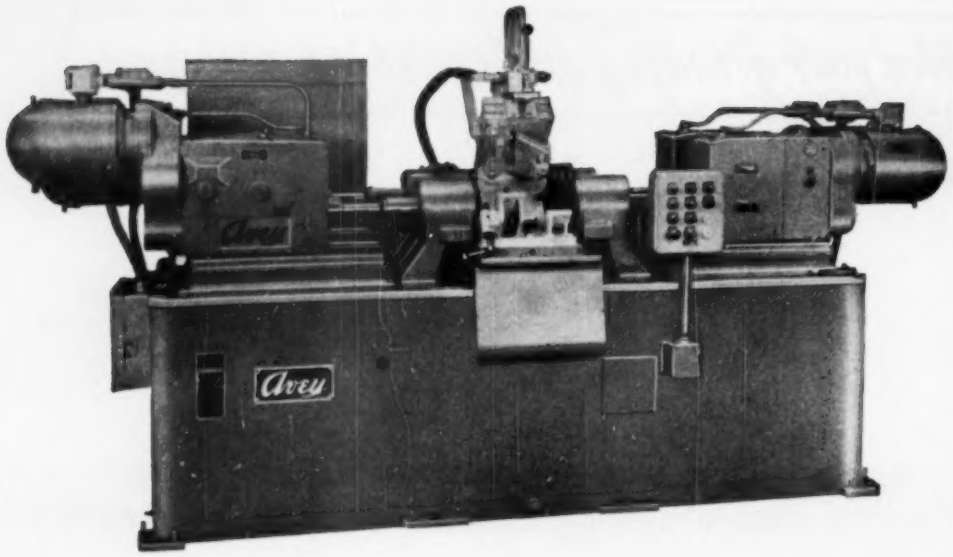
Name .....

Company ..... County .....

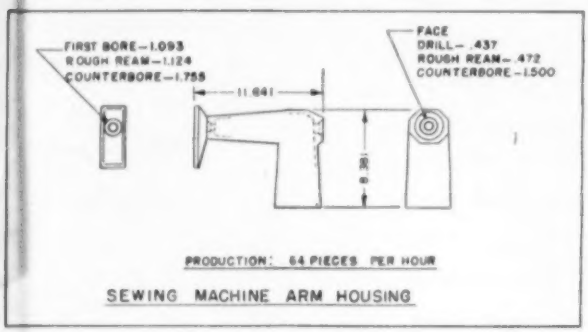
Address ..... Zone ..... State .....

City .....

MANNING
TROY, N. Y.
abrasives SHARPENING STONES



Avey PRODUCTION TYPE BORING MACHINE



Part—Sewing Machine Arm—Cast Iron and Aluminum.

Production—Increased 100% over previous method.

MACHINE S. O. No. 17676

Above machine utilized four (4) No. 2 *Avey* Automatic Cam Feed Units mounted horizontally on a steel fabricated base. Each spindle rigidly supported at cutting position by heavy duty precision needle bearings.

Fixture—Clamping done at one stroke with equal force by hydraulic cylinder. Fixture traverse from No. 1 station to No. 2 station and back is automatic by hydraulic cylinder.

Machine accommodated four different sets of fixtures for different sewing machine arms.

Machine included latest design of electrical control panel with electrical interlock between all unit parts of machine.

Replace your obsolete Drilling and Tapping Equipment with **Avey** Special Machines. Write *today!*

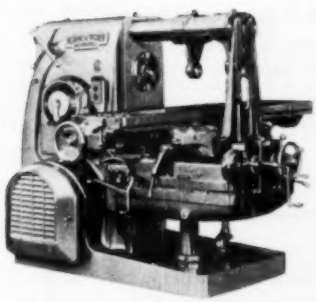
CINCINNATI · OHIO **Avey** DRILLING MACHINES

THE AVEY DRILLING MACHINE CO.
CINCINNATI 1 OHIO

GREATER RIGIDITY

New CK columns give you extreme Rigidity — provide a backbone structure far stronger than any you've ever known. Compared to former columns, they give you 1000 pounds more of dense, high-test iron scientifically distributed in close heavy section ribbing, in box-type sponson construction — built to absorb the heaviest cutting loads.

A new line of knee-type milling machines KEARNEY & TRECKER MILWAUKEE CK's



New Model CK
25 hp No. 5 Plain Style
Milling Machine

YES, Kearney & Trecker's new CK milling machines are packed with design and operating features that make them *more productive, more profitable for you.*

Spindle-mounted flywheel, broad feed and speed ranges and greater horsepower with separate motor drives for spindle, and feed and rapid traverse, mean you get fullest possible benefit from modern cutting tools.

New design 2" diam. table feed screw affords greater bearing contact between screw and nut and is equipped with positive-acting backlash eliminator. These features guarantee smoother feed for conventional and climb milling, give you longer screw life and greater accuracy.

For greater production, these machines are equipped with Kearney & Trecker's famous Mono-Level Control that shortens floor-to-floor time, and materially reduces operator fatigue. New, non-glare micrometer dials help avoid costly errors in reading . . . give you a positive lock at every setting.

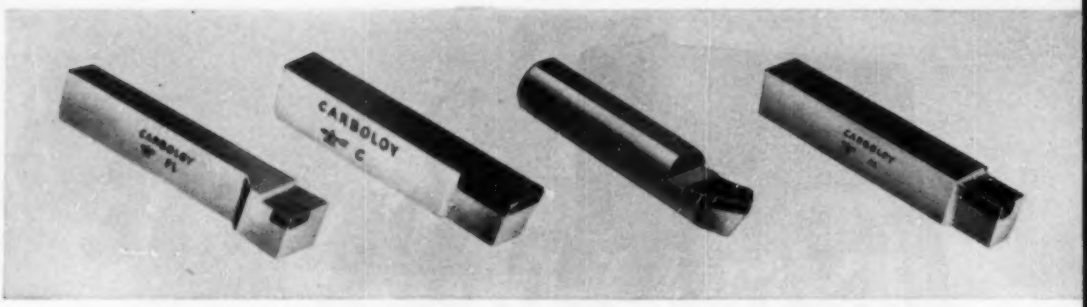
Automatic flood lubrication in column and knee and positive metered lubrication to table and saddle, plus generously proportioned gears and shafts assure you greater machine life.

Find out for yourself about Kearney & Trecker's new CK line of knee type milling machines . . . how they meet every demand of modern milling practice . . . how they can give you greater production at greater profit.

Sizes are No. 2, 3, 4, 5, and 6 . . . Plain and Universal styles. For complete details, contact your nearest representative or write direct. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

REPLACEMENT OF OBSOLETE MACHINE TOOLS
IS AN INVESTMENT THAT MAKES BOTH DOLLARS AND SENSE

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS



"Typical of the more than 700 standard Carboloy Tools and Blanks stocked by distributors in 88 cities, coast to coast."

Uniformity is the keynote

. . . and it pays

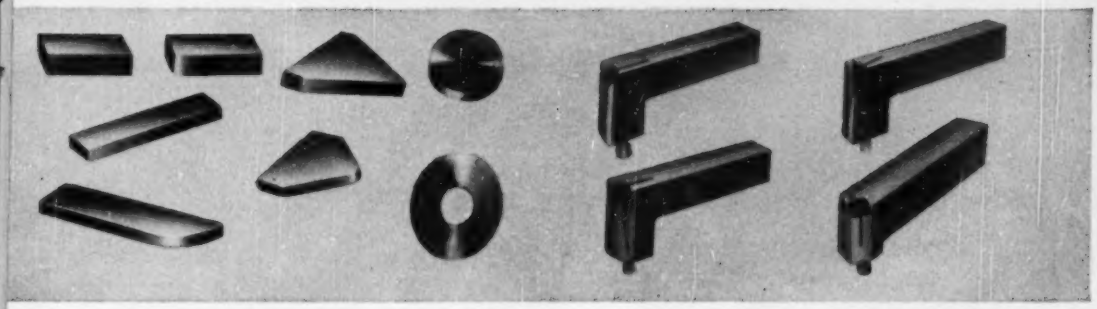
WHEN YOU SPECIFY Carboloy Cemented Carbides, you can be sure that you'll get uniformity—in every tool, in every order, in every re-grind.

And you can be sure, too, that this uniformity pays off—by helping reduce costs, eliminate waste and increase production in your plant.

You find proof of this pay-off everywhere in industry—in case histories like those on the opposite page, or among manufacturers you personally know who have found standard Carboloy Tools and Blanks to be the answer to their metal cutting problems.

Why not be sure you're getting the most out of *your* carbide operations? Use standard Carboloy Cemented Carbides *today;* realize their benefits tomorrow. Carboloy Company, Inc., 11149 E. 8 Mile Road, Detroit 32, Michigan.

RESULTS are more spectacular when Carboloy Cemented Carbides are used under the unique "Triple C" Plan of Coordinated Carbide Control. Get your copy of the CCC Plan Book, which explains in detail how this program operates.



"Typical of the more than 700 standard Carboloy Tools and Blanks stocked by distributors in 88 cities, coast to coast."

# of Carboloy Quality

dividends for you in *plant-wide* results like these!

1 Lowest *plant-wide* average tool cost per piece machined

"Tool life has been increased from 6 to 50 times, with piece production almost doubled in many cases."

*Eastern washing machine manufacturer**

2 Lowest *plant-wide* average machining cost per piece machined

"In 1500 jobs tooled with Carboloy, machining costs dropped an average of 25% and machine capacity increased an average of 43%."

*Machine tool manufacturer**

3 Highest *plant-wide* average production per machine

"With fewer machine tools in operation, production was more than doubled, but cost per piece was not increased . . . despite material cost increases."

*Midwest manufacturer**

4 Close *plant-wide* production control standards to which you can absolutely adhere

"Our tool and methods engineers have used predetermined time standards, but have found greatest benefits are possible only with long life and repeated uniform performance of carbide tools."

*Large manufacturer of pumps**

* Name on request

CARBOLOY COMPANY, INC.

11149 E. 8 Mile Road, Detroit 32, Michigan

CARBOLOY® CEMENTED CARBIDE — THE UNIFORM CARBIDE

. . . in every tool . . . in every order . . . in every re-grind

stainless is no pipe dream

There's no reason to blow smoke rings of fantasy about stainless steels. Since stainless steel is a versatile *family* of steels, the right analysis must be used or stainless will not perform its "miracles" in your application. Crucible, pioneer in the development of these specialty steels, makes freely available to you an alert staff of metallurgists — experts in the application of stainless. Crucible's engineers and metallurgists can show you the right grade and finish you need . . . and how Crucible Stainless offers you maximum satisfaction.

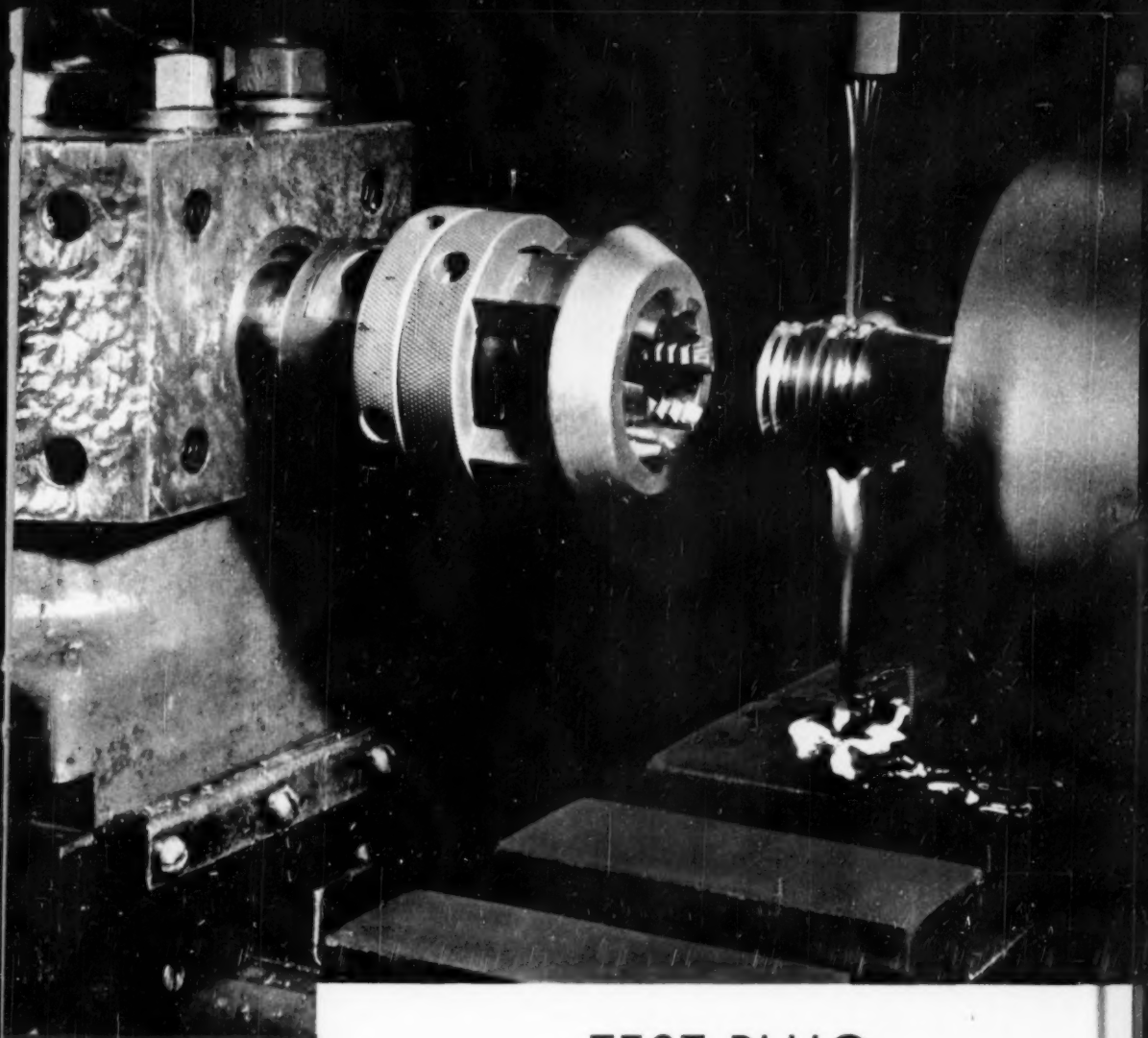
Whatever your application may be, Crucible is prepared to help you. Crucible's half century of specialty steel leadership is based on finding the best way to solve Industry-posed problems. Whether the order is in tons or pounds . . . your application will receive this same careful attention. When you think of stainless . . . call Crucible. CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, New York.

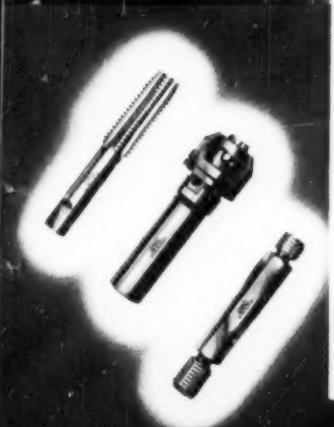
CRUCIBLE first name in special purpose steels

STAINLESS STEELS

fifty years of Fine *steelmaking*

STAINLESS • HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS





TEST PLUG

There are tests ***and*** tests, but the best one is actual performance.

Every "Acorn" Die is performance tested at the factory in an operating holder running at high speed on specially selected test stock.

The test plug is then gaged for pitch diameter, outside diameter and lead; and visually inspected under a glass for thread quality. Furthermore, the accepted plug is *packaged* with its own Die, tangible proof that the Die is *right*.

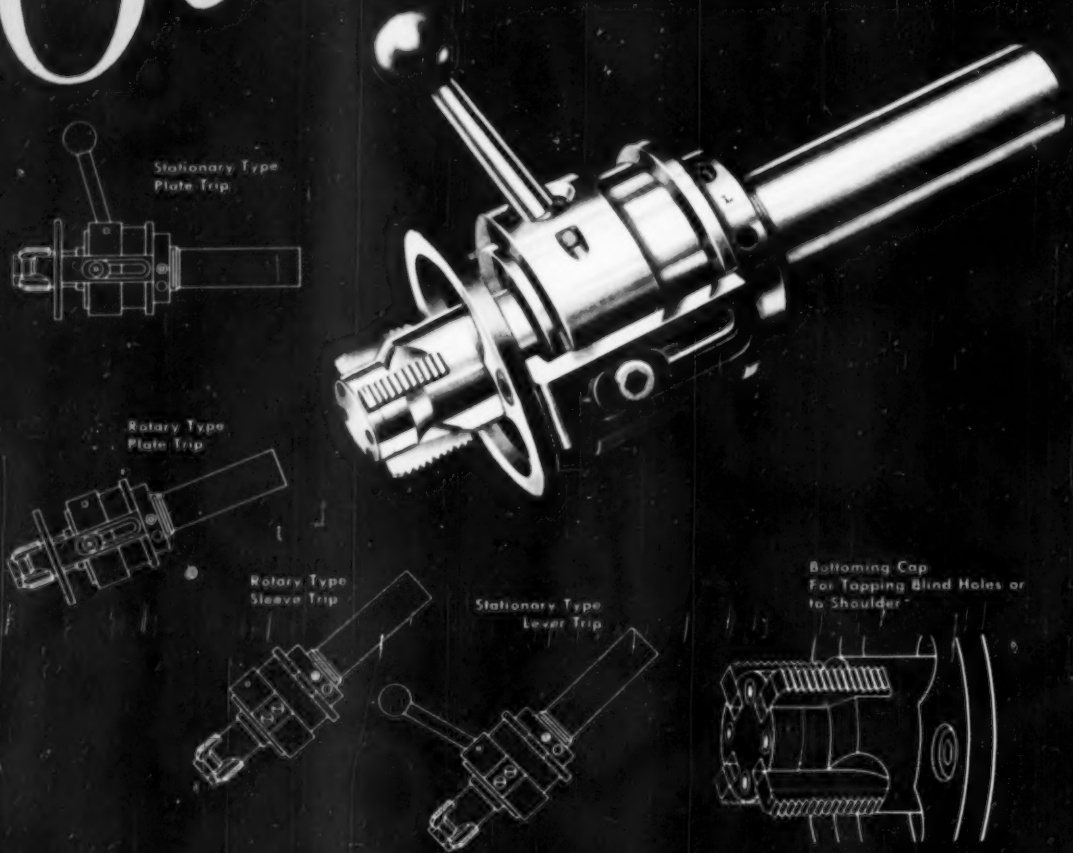
BUY DIES WITH *CONFIDENCE*
BUY *"ACORN"* DIES

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS

Geometric "S"

UNIVERSAL COLLAPSING TAPS



Convertible into both Rotary and Stationary Types in eleven sizes and adaptable to most standard makes of machines without the need of additional parts, the Class "S" is indeed the UNIVERSAL COLLAPSING TAP.

Capacity $1\frac{5}{16}$" to $8\frac{1}{2}$" Straight Threads or 1" to 7" Pipe Threads

WRITE FOR LATEST BULLETIN S

BE SURE Buy GEOMETRIC

GEOMETRIC TOOL COMPANY DIVISION

GREENFIELD TAP AND DIE CORPORATION

NEW HAVEN 15, CONNECTICUT

Wet Blanket

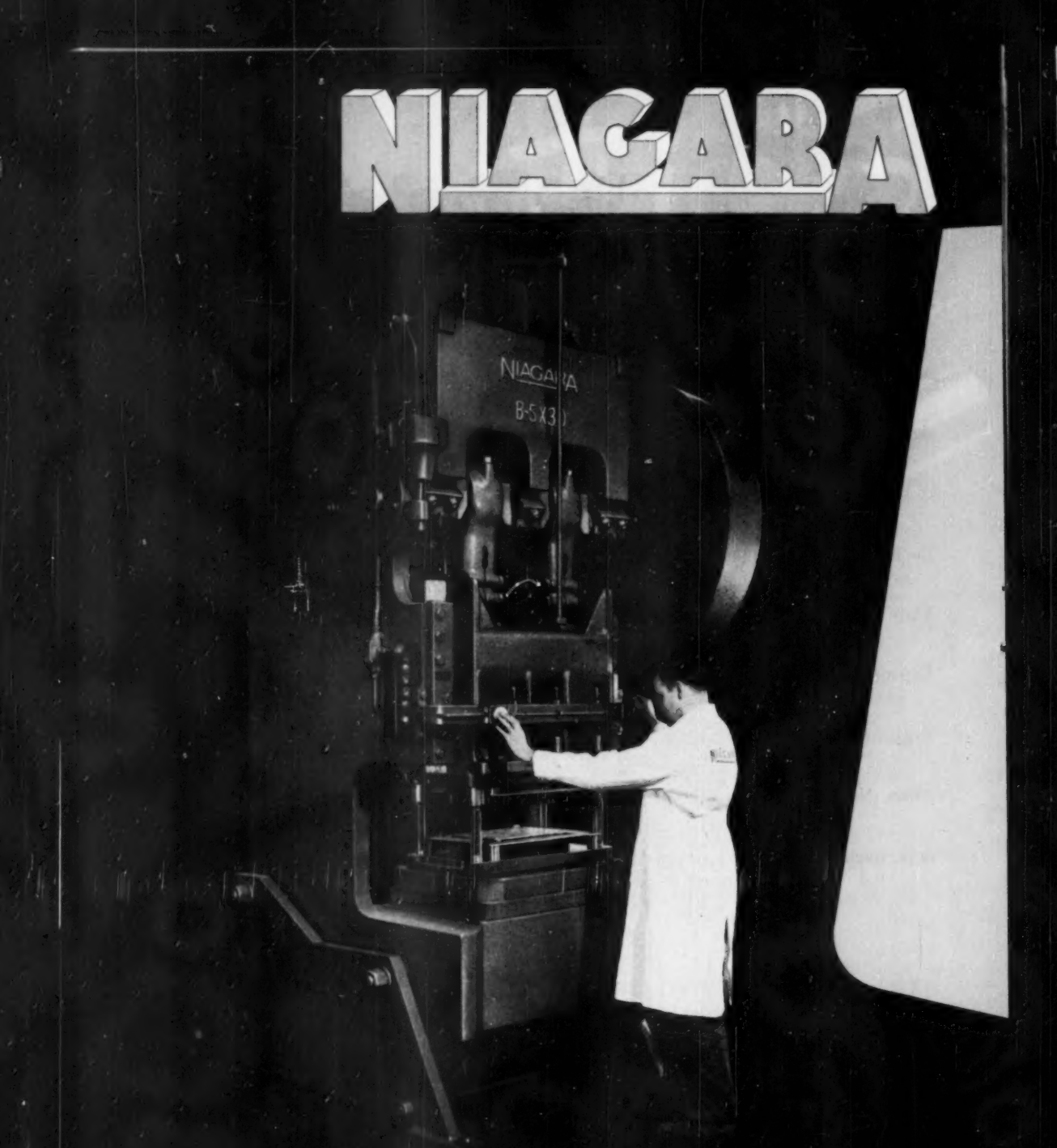
This manufacturer of dictation machines wanted a new model packed with sales appeal. Make it small. Make it light enough for business trips. The designers drew up an all-magnesium model. Light as a feather . . . rugged. The boss said, "I hate to be a wet blanket, but our shop has never handled magnesium." To convince the boss, the designers called in light-metal headquarters . . . Aluminum Company of America. They outlined the simple procedures that make handling magnesium easy. Explained that American industry uses over three million pounds of magnesium every month. Suggested that the dictating machine parts be die cast in magnesium by Alcoa. Now the new model is in production. It's lighter—saves in production costs. The sales department is setting new records every month with it.

These two free books on magnesium and our broad technical experience can help your products, too. Write: Aluminum Company of America, 2106G Gulf Building, Pittsburgh 19, Pa. Sales offices in principal cities.

ALCOA

ALUMINUM and MAGNESIUM

NIAGARA



Niagara No. BI-5x30 Gap Frame Double Crank Inclinable Press fitted with magnetic perforating dies made by S. B. Whistler & Sons, Inc., Buffalo, N. Y.
Press equipped with air actuated electrically controlled sleeve clutch.

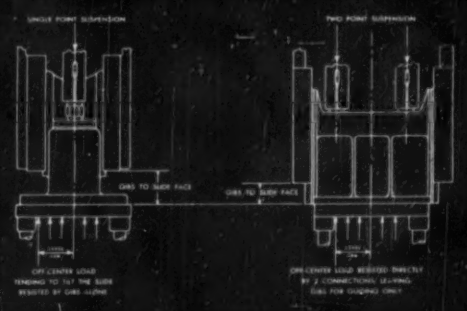
Write for Specifications

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

PRESENTS The NEW

No. BI-5x30 Double Crank Inclinable Press

Gap Frame with one-piece welded steel frame



- Gives full support to wide dies, impossible to obtain on the conventional single point Inclinable Press even with slide flanged out.
- Gibbing may be brought closer to point of load application on this double crank press than with flanged slide single crank design.
- Two point suspension resists tendency of slide to tilt under off-center loading conditions.
- Niagara gap frame construction gives equal access to all four sides of die. No ribs or shafts extending across the back of press.
- Inclined position permits finished work to drop off the rear of the press.
- Gearing enclosed and running in oil.
- Backshaft mounted on anti-friction bearings.
- Air counterbalance for slide.
- Bronze bushed main and connection bearings.
- Niagara electrically controlled air actuated sleeve clutch.
- Air releasing brake.

Similar presses are made in sizes ranging from 3½" to 6½" diameter shaft. Sizes 3½" and 4" are made with mechanically operated sleeve clutch.

Illustration shows Niagara No. BI-5x30 press in inclined position.

Manufacturers of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK

a SINGLE trial grind instead of MANY!

with the *ELECTRALIGN*

Here's the simple set-up procedure for grinding machines equipped with ELECTRALIGN, the exclusive Brown & Sharpe development for swivel table alignment:

(a) *operator inserts piece in grinding machine and makes the usual machine setting . . .*

(b) *preliminary grind is taken . . .*

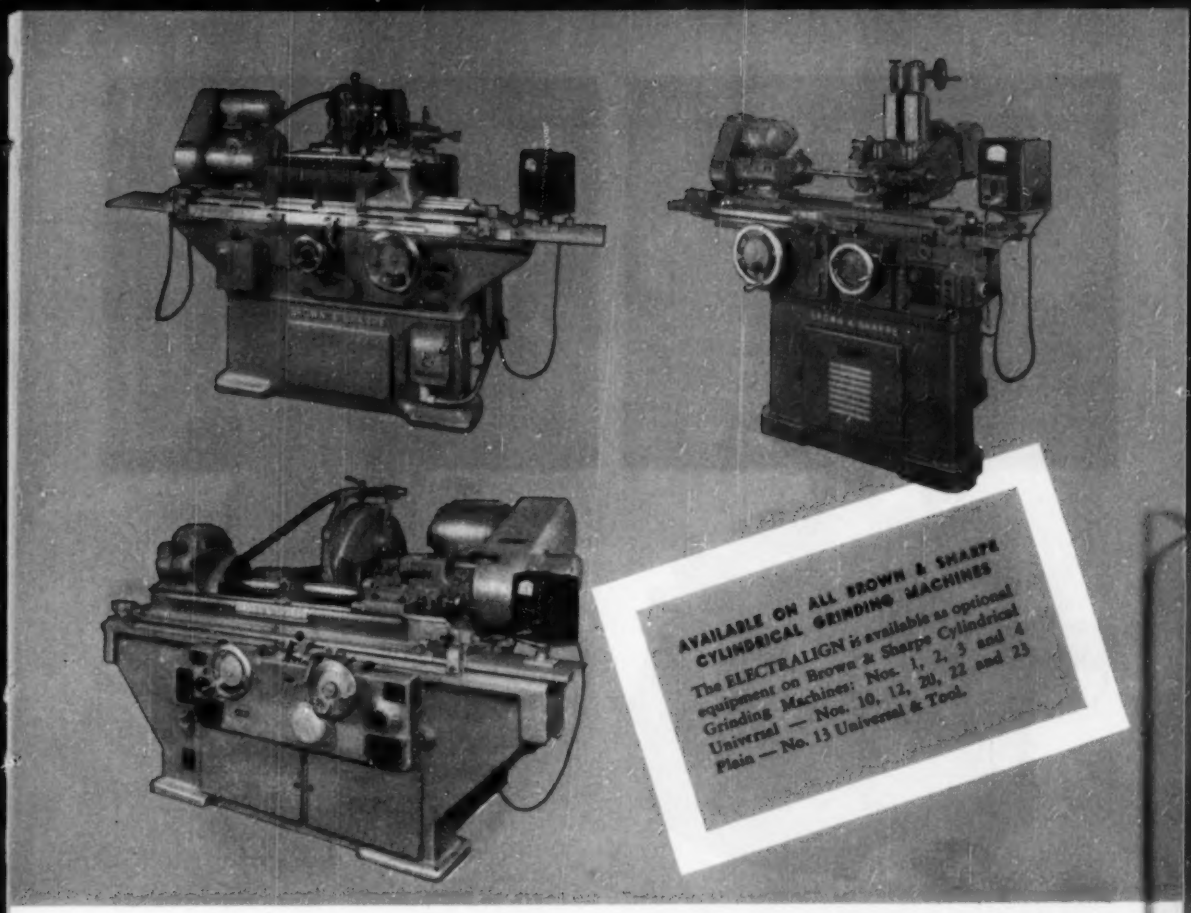
(c) *measurement is made of the amount by which piece deviates from desired straightness or taper . . .*

(d) *after the meter pointer has been set to the amount it is desired to swing the work, the operator makes a single positive correction by adjusting the swivel table until ELECTRALIGN needle reads zero . . .*

FROM THERE ON . . .

OPERATOR IS PRODUCING!

BROWN &


AVAILABLE ON ALL BROWN & SHARPE CYLINDRICAL GRINDING MACHINES
The ELECTRALIGN is available as optional equipment on Brown & Sharpe Cylindrical Grinding Machines: Nos. 1, 2, 3 and 4 Universal — Nos. 10, 12, 20, 22 and 23 Plain — No. 13 Universal & Tool.

ELECTRONIC ALIGNMENT OF SWIVEL TABLE

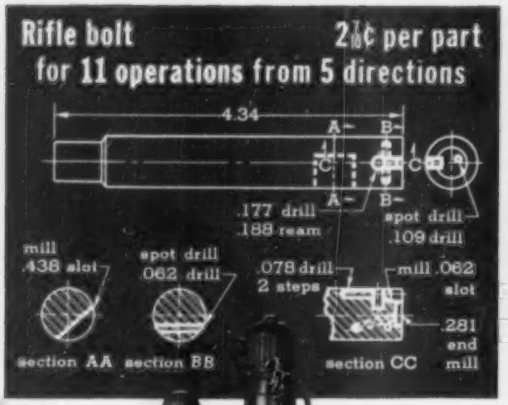
Setting the swivel table of a grinding machine to grind a straight shaft or an exact taper always has been a difficult cut-and-try operation. But it needn't be any longer! ELECTRALIGN makes it a simple, quick, direct job by measuring electronically the small angular movement of the grinding machine swivel table relative to the sliding table and magnifying it visually on the amplifier. A single realignment then gives the final precise table setting.

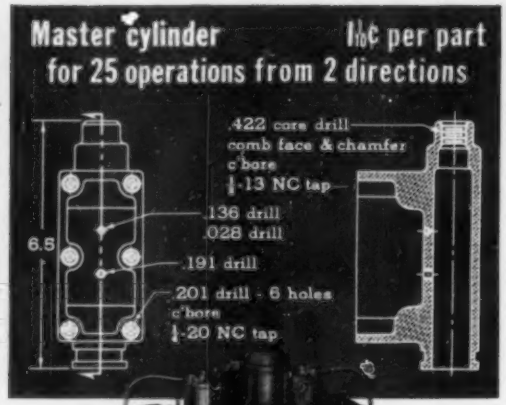
Full specified tolerance for sizing — Electralign makes possible the virtual elimination of taper in a straight piece and allows the operator the full blueprint tolerance for sizing — with resulting lower grinding cost and less scrap.

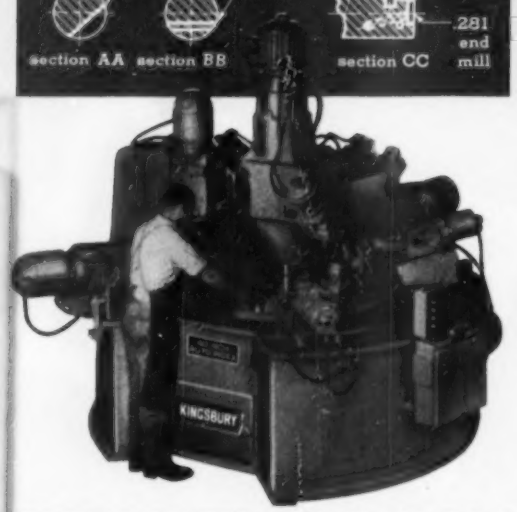
Recognized as one of the greatest modern advances in grinding, ELECTRALIGN assures important savings in time, money and strain on operators. It speeds production and improves the quality of the product.

For additional details or illustrated Bulletin, write Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

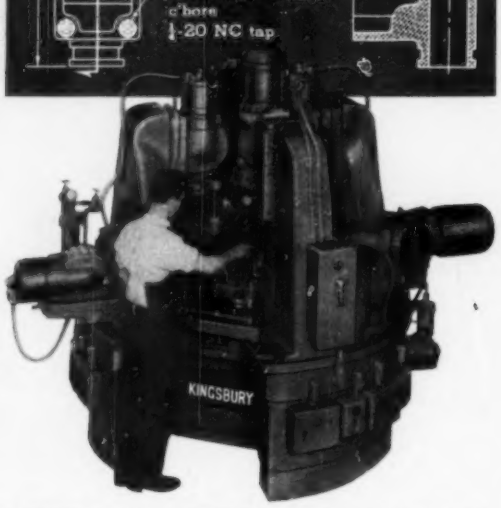
SHARPE B·S







330 PARTS AN HOUR GROSS. On this 40-inch "Auto-Index" a vertical unit mills the .438 slot; four units on the central column and inverted at 45° do the .062 and .188 holes; six units on the base do four axial operations and the .109 angular hole.



630 PARTS AN HOUR GROSS. A 20-inch power index table has eight fixtures. Four vertical units operate on the axial hole. Six horizontal units, three with 6-spindle auxiliary heads, operate on the other holes. The .028 drill runs at 14,000 rpm.

Cut unit costs with many

High production drilling and tapping machines, either simple or complex, combine operations to save money

Dear Sir:

These high production machines save money. The pay-off period is one to three years, or even less.

Each machine here replaces several general-purpose machines. One man loads and unloads each one. Automatic drilling and tapping units of 1/3 to 5 hp do the operations. That means a big saving in direct labor, some saving in handling and space.

Scrap is less, since each machine produces uniform, accurate parts. Automatic work cycles never vary. Fixtures and index tables are jig-bored to such close limits that parts from all fixtures are exactly alike. Bushings locate drills and reamers to close tolerances.

Savings not always obvious

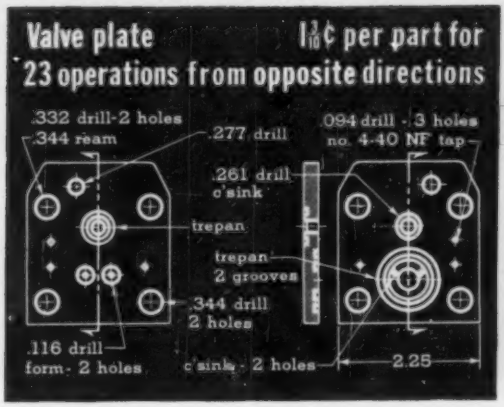
"A new Kingsbury," says an article in *American Machinist*, "drills, reams and countersinks both ends of a small roller, has cut time to only 0.18 min. per piece. Even though there is only enough work to operate it about a week a month, it has already paid out in labor and scrap savings."

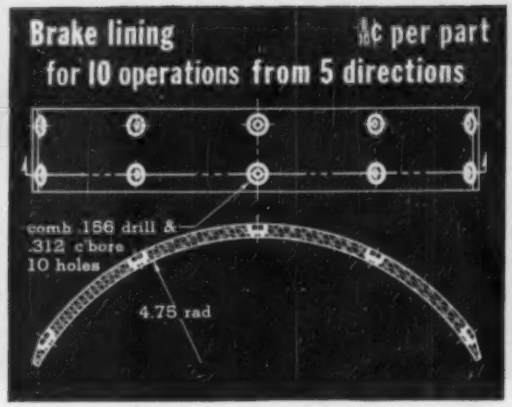
Firms have ordered Kingsburys when they needed only 25 or 30 parts an hour. You might think those machines would be a poor investment. But in each case someone figured out that there would be a good saving.

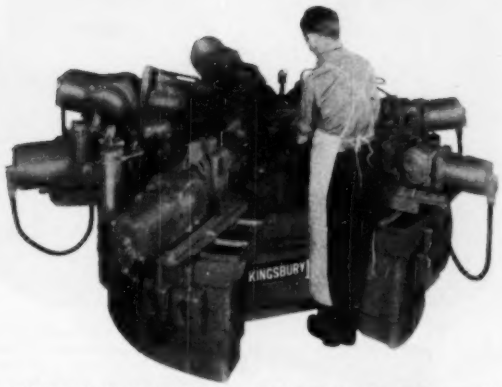
Not on old envelopes now

It used to be that you could take a proposal and figure the savings on any handy piece of paper. Nowadays many people use a work sheet of some kind. For one thing, it is easier for others to follow the figuring.

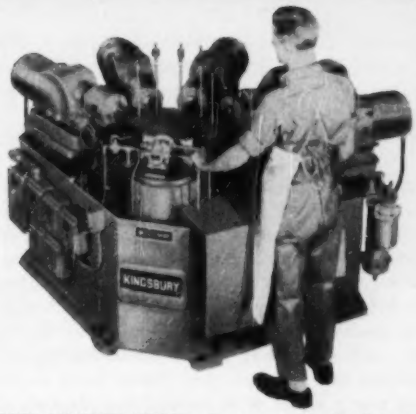
There is a good work sheet in the National Machine Tool Builders' booklet, *Computing Return on Invested Capital*. They describe the method fully. If you want a book-







500 PARTS AN HOUR GROSS. Each part passes twice around this machine. A 20-inch index table has eight double fixtures, each holding one part on each pass. Seven multi-spindle units do all 23 operations. Bushings guide all tools but the taps.



830 PARTS AN HOUR GROSS. Drop a part in the fixture and trip a lever. The fixture locates and clamps. Five 2-spindle units operate. The fixture unclamps and ejects. Time: 3½ secs. The operator can adjust the units to operate on similar linings.

operations per chucking

let free, ask us on your business letterhead.

Unit costs on the drawings

Not to be outdone, this is how *we* figured each unit cost above. It includes only the cost of the man and of the machine. We assumed:

Unit cost of the man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross x 80\% efficiency}}$$

Unit cost of the machine equal to:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hours @ 80\% efficiency}}$$

You may not like our assumptions on efficiency, wage rate or 6000 hours. But at least the method is sound. We had to assume things, but you can use *actual* figures. You get a realistic result, whether or not your machine runs full time.

Instead of an average hourly wage you can use your actual wage (with or without hourly fringe benefits). Instead of output in 6000 hours, you can use your output in either your pay-off or "useful life" period.

You can complete the picture by comparing that cost with your unit cost now and estimating savings in overhead. That was beyond us here.

Don't get us wrong. Savings are often so obvious you need not figure them on paper. But you can't judge savings without proposals. If you want us to quote, send a print to our Mr. L. A. Carll and tell him the operations and output you need. Free bulletins show what we can do.

Sincerely,
Kingsbury Machine Tool Corp.
140 Laurel Street, Keene, N. H.

KINGSBURY
AUTOMATIC DRILLING & TAPPING MACHINES
for Low-Cost High Production

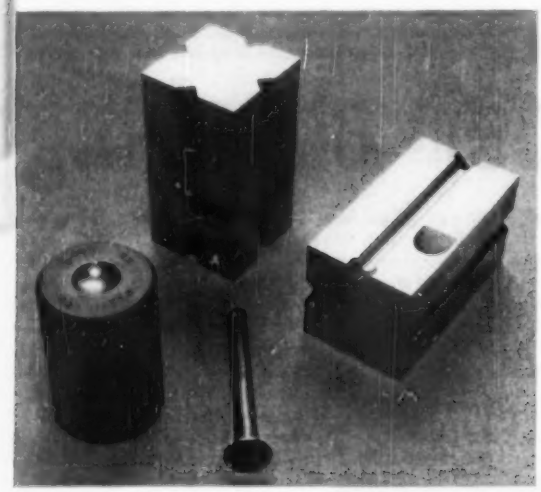
COLD-HEADING DIE STEEL for *maximum production*

BETHLEHEM XX COLD-HEADING DIE STEEL is more than a match for the most punishing cold-heading jobs. It's the finest steel of its type, having been developed just for cold-heading dies.

It's a special grade of carbon tool steel, having a carbon content of 0.90 to 1.00 pct. Long years of intensive development work were required to arrive at the ideal carbon range, depth of hardness, and grain size which give best service for various sizes of header dies. We recommend a shallow-hardening grade for header dies up to 2-in. diameter; for larger dies a deep-hardening steel has proven most suitable.

This special-purpose steel has controlled hardenability, and every bar represents the ultimate in cleanliness and freedom from flaws. Rigid controls govern every phase of its careful manufacture and inspection. But the real test is the way it meets cold-heading requirements: a hard working surface with good wear-resistance, reinforced by a tough core . . . case-hardness deep enough to prevent sinking or upsetting . . . tough enough to absorb heavy pounding without chipping or spalling.

Bethlehem Cold-Heading Die Steel gives maximum die life in the cold-heading of steel rivets. At left is the header die; at right, the solid die.



These gripper and header dies of Bethlehem Cold-Heading Die Steel provide the ideal combination of hard working surfaces and tough core for the cold-heading of bolts.

Large users of cold-heading steel give Bethlehem XX Cold-Heading Die Steel their unqualified approval. And we use this grade ourselves in large quantities in Bethlehem manufacturing operations. You can count on it for maximum production at lowest cost. Our metallurgists will gladly work with you in arranging for a trial in your plant.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem ULTRASONIC TESTED **Tool Steel**

Housing Shortage? . . . *Put them on a Blanchard*

A manufacturer was getting 1 to 2 gear case housings (right) per hour by a former method — now a Blanchard No. 18 is grinding the joint surfaces of 8 to 9 pieces per hour. Up to 3/16′ of cast iron is removed per piece. 3 pieces are produced in a single operation to required tolerance.

Thirty transmission housings per hour (left) are finish ground on a Blanchard No. 11, removing .010′ from previously machined castings. They are held flat to .001′ and to ±.002′ for size. A special Blanchard-designed holding fixture, actuated by a single wrench motion, helps produce these housings in such short time.

There will be no housing shortage in your plant if you use a Blanchard Surface Grinder—may we grind your samples to prove our point?

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

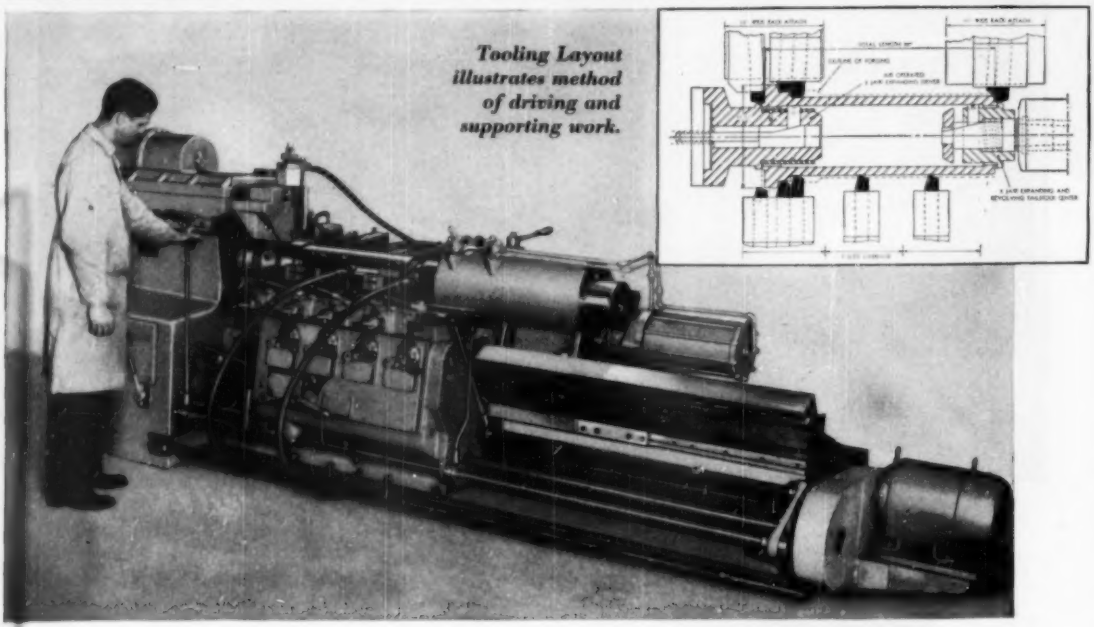
NO. 18 BLANCHARD SURFACE GRINDER

PUT IT ON THE BLANCHARD THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK



Tooling Layout illustrates method of driving and supporting work.

NEW Lo-swing LATHE MACHINES
LARGE PUMP LINERS OF VARIOUS SIZES

Problem: To turn, square and chamfer large pump liner forgings, varying in size from 4" dia. x 10" long to 12" dia. x 30" long, on a single machine with a change of tools and drivers only.

Solution: The new Model "LS" Lo-swing Semi-Automatic Lathe was chosen for this job because of ease of change-over for various sizes, and its ability to transmit 100 H. P. to the cutting tools. Work comes to the machine with the bore rough forged, O. D. must be turned concentric with the rough bore. The piece is held at the headstock end by a 3-jaw, air-operated, expanding arbor, while the tailstock end is supported by a 3-jaw, expanding plug center, the jaws of which expand when the tailstock quill moves forward. Turning is accomplished with 5 tools mounted on the 3 front carriage slides. Shoulders are squared and chamfered with 5 tools mounted on 2 back-squaring attachments.

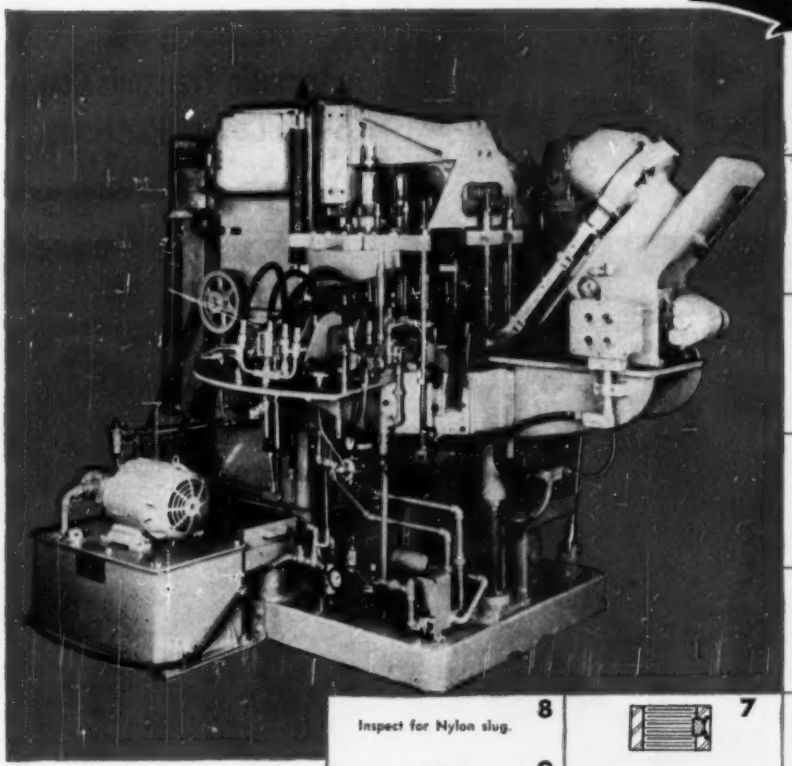
The New Model "LS" Lo-swing is designed to take full advantage of modern sintered carbide tools having tremendous capacity at high cutting speeds and coarse feeds, coupled with an ability to transmit up to 100 H. P. Other features include unlimited carriage travel, power feed to individually-controlled carriage cross slides, rapid traverse on all carriage and back attachment movements, etc. Write for Bulletin LS-50 describing this new lathe for heavy, multiple-tool turning.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Bodine CASE HISTORY NO. 26

AUTOMATIC DRILLING, TAPPING, ASSEMBLY AND ELECTRICAL INSPECTION OF A SPECIAL NUT



1 Automatically hopper feed Hex Nut Blanks to dial. 2 pieces per stroke.

2 Horizontally drill hole to half depth.

3 Horizontally drill hole thru.

4 Electrically inspect for drilled hole.

5 Tap thread thru nut.

6 Shear off Nylon slug and automatically insert in drilled hole.

7 Hydraulically stake Nylon slug to proper depth.

8 Inspect for Nylon slug.

9 Automatically eject finished nuts.

PRODUCTION

Battery of machines tooled for all sizes of nuts to and including ½" dia. Various materials. Production on ⅜ — 24 standard steel nut is 44 pieces (or 396 operations) per minute.

One operator handles a battery of machines.

Bodine machines can jump your competitive position to the top. Make our engineers prove it. Write for Bulletin.

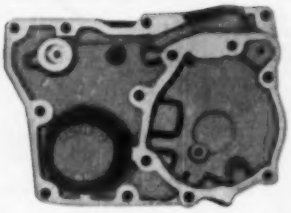
"You can't meet Tomorrow's Competition with Yesterday's Machine Tools"

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

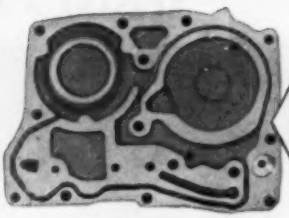
28D50

2700 OPERATIONS PER HOUR

Drilling, Reaming, Rough & Finish Counterboring, Chamfering, Spotfacing & Tapping

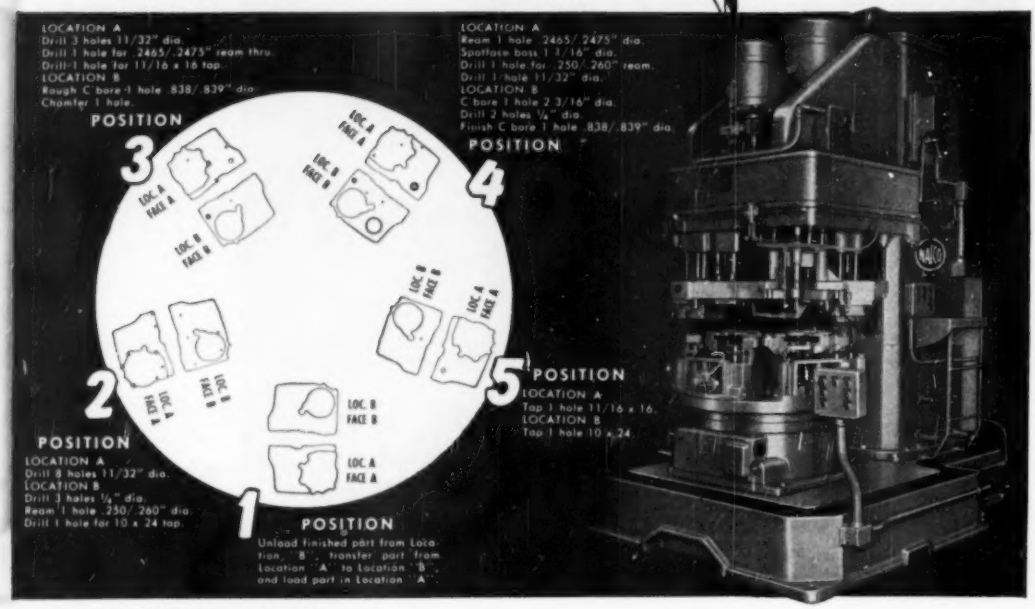


FACE A



FACE B

Producing 90 Automatic Transmission Servo Covers Per Hour


LOCATION A
Drill 3 holes 11/32" dia.
Drill 1 hole for .2465/.2475" ream thru.
Drill 1 hole for 11/16 x 16 tap.
LOCATION B
Rough C bore 1 hole .838/.839" dia.
Chamfer 1 hole.
POSITION
3
LOC. A FACE A
LOC. B FACE B
LOC. A FACE A
LOC. B FACE B
4
POSITION
LOCATION A
Ream 1 hole .2465/.2475" dia.
Spotface boss 1 3/16" dia.
Drill 1 hole for .250/.260" ream.
Drill 1 hole 11/32" dia.
LOCATION B
C bore 1 hole 2 3/16" dia.
Drill 2 holes ¼" dia.
Finish C bore 1 hole .838/.839" dia.
LOC. B FACE B
LOC. A FACE A
2
POSITION
LOCATION A
Drill 8 holes 11/32" dia.
LOCATION B
Drill 3 holes ¼" dia.
Ream 1 hole .250/.260" dia.
Drill 1 hole for 10 x 24 tap.
LOC. A FACE A
LOC. B FACE B
LOC. B FACE B
LOC. A FACE A
5
POSITION
LOCATION A
Tap 1 hole 11/16 x 16.
LOCATION B
Tap 1 hole 10 x 24.
1
POSITION
Unload finished part from Location "B", transfer part from Location "A" to Location "B" and load part in Location "A".

Write today for NATCO—National Cash Register Co. "Success Story" No. 4

NATCO DRILLING, BORING, TAPPING AND FACING MACHINES

Dept. AM

THIS NEW MULTI-OPERATION NATCO HOLESTEEL MACHINE performing automatic machining operations at each of four positions simultaneously is one of many NATCO machines contributing to lower costs. Send us your drilling, boring, tapping and facing problems . . . our engineers have the solution.

NATCO

Call a Natco Field Engineer

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Ind., U. S. A.

Branch Offices: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City

THE FRONT OFFICE IS ON MY NECK TO CUT TOOL REPLACEMENT COSTS AND GET MORE PRODUCTION. GOT ANY IDEAS?
SURE, LET'S STANDARDIZE ON SHIELD BRAND CUTTING TOOLS. THEIR UNIFORM QUALITY IS TOPS. FROM NOW ON WHEN WE NEED TOOLS LET'S SPECIFY "STANDARD."
SMART BOYS-- SMART BOYS
RED SHIELD

STANDARD means $AVING$

Consider the time and cost savings that can be realized in your operation by using Standard Shield Brand Tools.

Foremost Quality—that reduces your costs—because of unexcelled design, material and workmanship.

Reliable Performance—that speeds your production. Proved because Shield Brand Tools are specified and used in every mass production industry.

Complete Service Stock—that saves your time. Over 10,000 items carried in stock, supplied by warehouses in principal cities.

Standardize—and save. Call your Industrial Supply Distributor for prompt delivery of Standard Shield Brand Tools.

STANDARD TOOL CO. CLEVELAND 4, OHIO

STANDARD TOOL CO.

New York • Detroit • Chicago • San Francisco

THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

Another user finds

COPYMATIC "SUPERIOR"

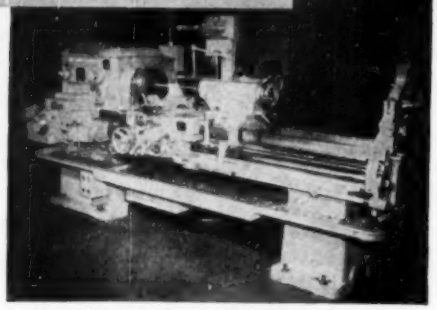
"Lower Tooling Cost...
Simplicity...
Speedy Changeover"

says Continental Motors Corporation
Muskegon, Mich.

DUPLICATE PARTS OR DO REGULAR LATHE WORK
...get instant changeover ONLY with the Copymatic

MACHINING cylindrical steel parts in limited lots, a Lodge & Shipley COPYMATIC Lathe aids in the production of famous "Red Seal" Continental Engines. Read what a production executive of this firm has to say: "We purchased a 16" Lodge & Shipley Lathe, with Copymatic attachments, to answer our needs of a machine for contour turning, facing, chamfering, etc., cylindrical steel parts in limited lots for our production. The set-up has proven very satisfactory in every respect and especially from the standpoint of low tooling cost and simplicity and speed of changeover."

With a COPYMATIC, you get all the convenience and speed of hydraulic duplication, plus the outstanding versatility of the Lodge & Shipley "Model X" Lathe. You get instant changeover from standard lathe operation to automatic duplication or vice versa. Using either round or flat templates, the COPYMATIC reproduces square shoulder faces, grinding necks, tapers in both directions, chamfers and curved contours. Often a special template is eliminated. The first piece, produced by standard operation, is inserted between the template supports and the rest of the lot produced automatically.



Without the limited use and resulting higher costs of a "special purpose machine," the COPYMATIC is a profitable producer in any size shop. Ask a Lodge & Shipley Representative for additional details or write for Bulletin No. 675.

THE **Lodge & Shipley** COMPANY
MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

Laboratory Products for MEASURING THICKNESS

G-E X-Ray and Beta-Ray Thickness Gages
—for measuring moving strips

These gages enable you to save in two ways in the high-speed production of sheet or strip materials:

1. You can cut scrap losses

Because these equipments indicate thickness as soon as the strip starts through the mill, you can reach gage in a hurry.

Operators at Weirton Steel Co., West Virginia, for example, report that their G-E X-Ray Gage enables them to reach gage on the first strip.

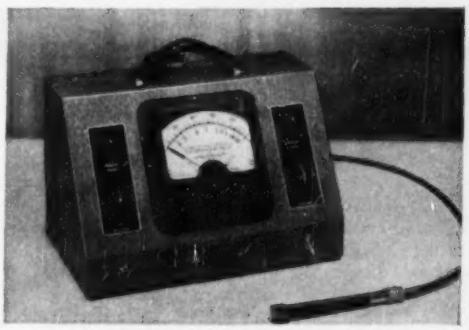
2. You can make savings in raw materials

Because the gages enable you to hold close tolerances, you can produce the maximum amount of strip or sheet from raw material.

X-Ray Gages are for heavy-duty work in steel mills. Gages are available for measuring thickness of hot strip from .040 to 190 mild steel; of cold strip, from .005 to .040 mild steel. Write for GEC-471.

The Beta-Ray Gage is a general-purpose device for measuring sheet or strip metals, paper, rubber, glass, textiles, and plastics weighing from 5 to 300 ounces per square yard. Write for GEC-485.

Beta-Ray Gage measures moving sheet or strips which are wet, sticky, highly polished, or soft.



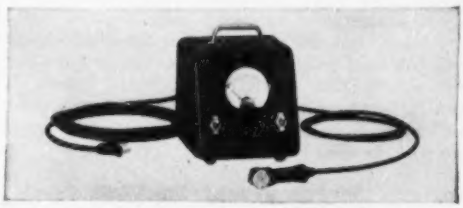
Type A Gage is ideal for production-line use on jobs such as measuring thickness of copper plating on parts for electronic tubes.

G-E Thickness Gages, Types A and B
—for measuring nonmagnetic materials

These gages help you to reduce scrap and rework expense by enabling you to spot quickly plating or coatings which are so thin that they do not meet specifications, or so thick that they waste materials.

The gages measure glass, plastics, paper, cellophane, mica, copper, brass, lead, and other nonmagnetic materials which can be placed over a magnetic reference plate.

Type A is for measuring the thickness of light plating; Type B, for heavy plating, or for bearing linings and paint. Write for GEC-319. Apparatus Dept., General Electric Company, Schenectady, New York.



Type B Thickness Gage is a low-price, general purpose gage for measuring thickness of paints, heavy platings, bearing linings. Range: 0.0001 to 0.1 inch.

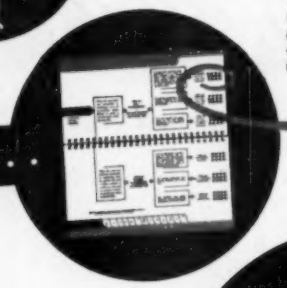
FOR HELP ON your measuring and testing problems . . . call the nearest G-E sales office

You Can Put Your Confidence In

GENERAL ELECTRIC

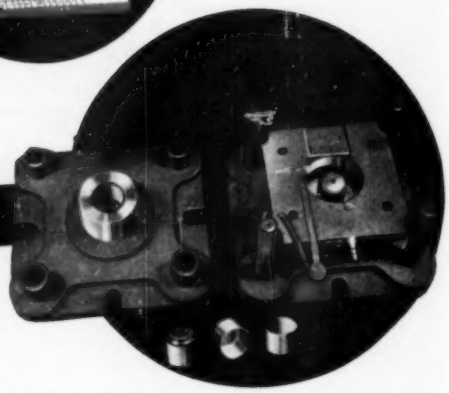
How ONE TOOLMAKER . . .

USED THIS GUIDE . . . . . .



—then use HAMPDEN (Oil-Wear) or No. 610 (Air-Wear)

TO HOLD DOWN UNIT COSTS . . .



AT which step in your tooling process would you welcome real help in reducing tool and die costs? Tool Steel Selection? Heat Treating?—or on-the-job "Trouble-Shooting"? Here's how you, like the maker of the Dies shown here, can start to reduce costs with a Method that helps you at *all 3* steps.

First, to simplify selection, use the handy Selector Section in the Carpenter Matched Tool Steel Manual. Quickly and surely, it enables you to put your finger on the proper steel for best results. Next, to further insure tool and die performance, use the Manual's complete heat treating instructions—they have been simplified beyond anything previously known. It's easy to get started—use the Carpenter Matched Set Method to help you "trouble-shoot" your present tool and die jobs.

For better, lower-cost tooling, put this practical, easy-to-use Method to work, now. Ask for the 189-page Carpenter Matched Tool Steel Manual—just see your Carpenter representative. The Carpenter Steel Company, 109 W. Bern Street, Reading, Pa.

IMMEDIATE DELIVERY FROM LOCAL STOCKS!

Call Your Nearest Carpenter Warehouse or Distributor

Offices and Warehouses in Principal Cities Throughout the U.S.A. and Canada

Export Department, Woolworth Bldg., New York 7, N. Y. "CARSTEELCO"

Job:
Compound Blank and Draw Die for forming .031", ¼-hard brass Vent Valve Bodies at the rate of 103 per minute on a punch press.

Problem:
Unit costs were on the upswing because the old dies wore too rapidly, causing frequent and costly machine shutdowns for regrinding.

Solution:
Looking for a die steel with maximum wear resistance, the toolmaker referred to the Selector Section in the Carpenter Matched Tool Steel Manual, and quickly arrived at Carpenter *Hampden* (Oil-Wear).

Heat Treatment:
Simplified instructions in the Manual were followed.

Results:
2 hours of costly machine downtime were eliminated *each day*—production per grind *rose over 300%!* As a matter of interest, the toolmaker takes off approximately .0005" per stoning and gets about 100 grinds from the Blank and Draw Die.

Carpenter

MATCHED

TOOL & DIE STEELS

WHY THE GEAR WITH A BACKBONE®
fits into machine design

Here are two reasons why the Farrel-Sykes continuous tooth herringbone gear—the famous *Gear with a Backbone*—is ideal for machine-tool applications.

1. PRECISION GENERATION — The Farrel-Sykes method of generation assures extreme accuracy of tooth spacing, contour and helix angle. This tooth-to-tooth accuracy pays off in smooth, uniform power flow. Backlash is reduced to a minimum and the load is distributed evenly across the entire face width.

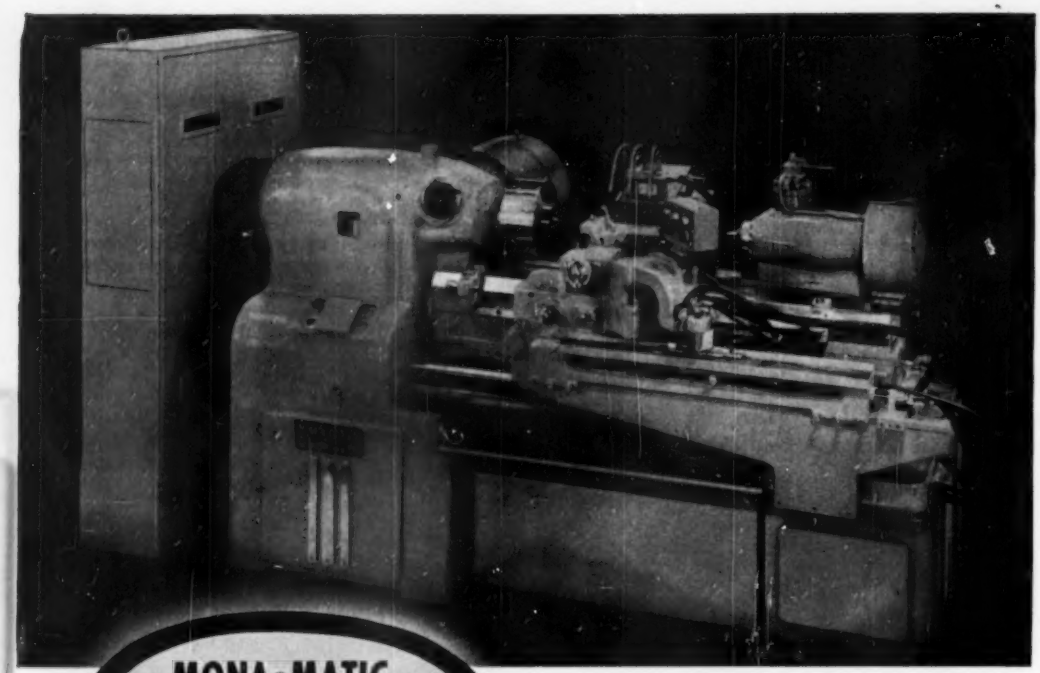
2. BACKBONE—The *backbone*, formed where the two helices meet without a center groove, puts the entire face width to work and provides extra strength and higher load-carrying capacity in less space — a definite advantage in many applications.

There are other factors which contribute to efficient operation and long gear life. Write for further information or engineering assistance on your gear problems.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT

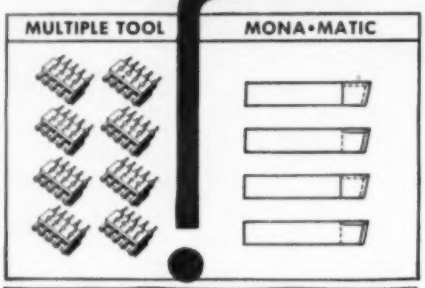
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. • *Sales Offices:* Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Cleveland, Cincinnati, Detroit, Chicago, Los Angeles, Tulsa, Houston, New Orleans.

Farrel-Sykes continuous tooth herringbone gears are used in the Sydney lathe headstock "for smoother rolling action."
The precision-generated Gear with a backbone is made in any size from ½ inch to 20 feet in diameter, ½ inch to 60 inch face, 24 DP to 0.75 DP.
Farrel-Birmingham
FB 59



MONA•MATIC or Multiple Tooling Methods ..WHICH?

LET'S TALK TOOLING COSTS!



	Multiple Tool Automatics (battery of four)	Mona-Matics (battery of two)
Production	120/hour	160/hour
Cutting Tools	**Cemented Carbide**	**Cemented Carbide**
No. of Tools	40	4
Cost of Tools (including one replacement set)	$4220	$187
Setup Time	28-30 hours	46 minutes
Total Horsepower	80-120	40
Floor Space	150-200% more than Mona-Matics	
Subsequent Grinding Operations		50% less time than multiple tool automatics

Would you rather pay $187—or $4,220 to tool up this job? It's just as simple as that.

On the typical steering knuckle job detailed at the left, *two* Mona-Matics, producing 33⅓% more parts than *four* multiple tool automatics, require *36 less tools* and *only two standard tool blocks!* And the multiple tool costs are figured on the basic minimum, two sets only. It might well be three or more sets, with correspondingly greater tool cost.

But bear in mind that lower tooling costs are not the whole story of the Mona-Matic's outstanding ability to cut your costs. You'll save on production time, on setup time, on accuracy, on power consumption and on floor space, too. For the full facts on how Monarch's famous Mona-Matics will outperform any ordinary multiple tool machining method, write for Bulletin 1804.

COMPARATIVE CASE STUDY

Part—Steering Knuckle,
SAE 1045, turned section—5⅜" long, ¾" to 3" diameter

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO. Sidney, Ohio

HOLES PER GRIND

Increased from 8 to 83!

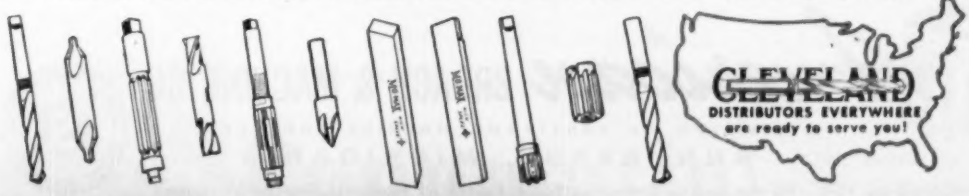
The *Right* CLE-FORGE stock drill gives spectacular performance

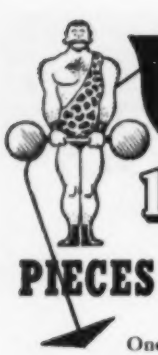
A farm implement manufacturer was having trouble drilling small holes 1½" deep in a shaft made of 1019 steel, very hard. Using regular drills, they were getting only 3 to 8 holes per grind. The drills burned on the corners from heat that was generated. When a *Cleveland* Service Representative was called in to solve the problem, he recommended the special purpose CLE-FORGE High Speed Drill, a stock item, illustrated at the left. No other change was made; speed and feed remained the same. *The CLE-FORGE High Speed Drills averaged 83 holes per grind . . . ten times more!* This is not an unusual case. There are several special purpose CLE-FORGE High Speed Drills, regularly stocked by your Distributor, which often can help you solve a difficult drilling problem. A *Cleveland* Service Representative will be glad to advise you. Contact our nearest Stockroom, or . . .

Telephone Your Industrial Supply Distributor

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS





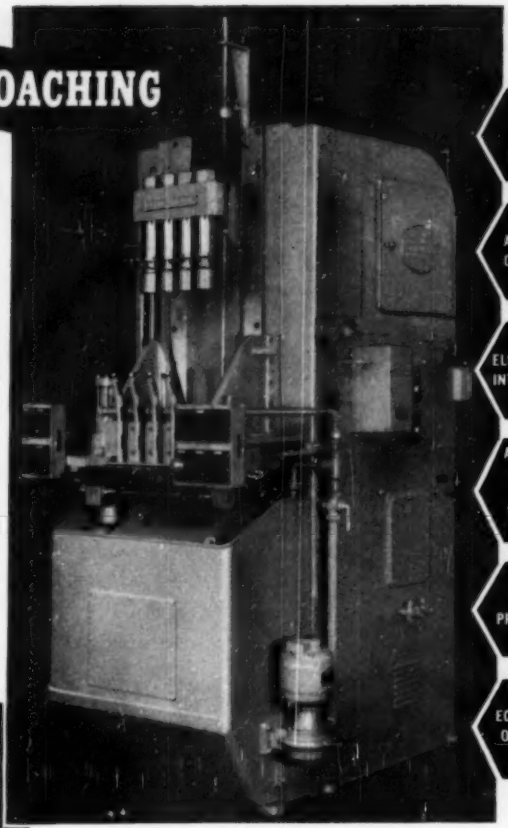
PULL UP BROACHING

1000

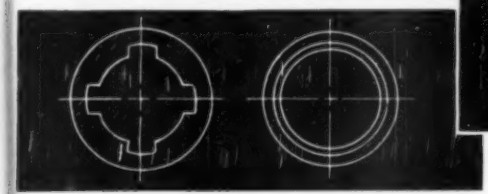
PIECES PER HOUR

One thousand pieces per hour are produced on this *American* fully automatic VP-3, 10-ton, 30-inch stroke internal broaching machine. Tube type magazines and hydraulic loading slide are provided. Loading slide is interlocked with the machine cycle to transfer the parts to the four identical broaching stations. The unit is completely automatic. The operator need only load the magazines.

American broach engineers will analyze your problem and recommend the proper broaching method and machine. There is no obligation for this service.



- MULTIPLE WORK STATIONS
- AUTOMATIC OPERATION
- ELECTRICALLY INTERLOCKED
- AUTOMATIC EJECTION OF BROACHED PARTS
- HIGH PRODUCTION
- ECONOMICAL OPERATION



Left: Four splines are broached on this sleeve. *Right:* .012 stock is removed from I.D. of this bearing. (These 1¼" long parts are shown actual size.)

WRITE for this *free* circular describing *American's* pull up broaching machines. Ask for circular VP.

This machine is tooled to broach the two parts illustrated at left. One operation is to pull broach the hole in bearings, removing .012 stock. *By changing only the broaches,* the machine is adapted to pull broach four splines in sleeve parts.

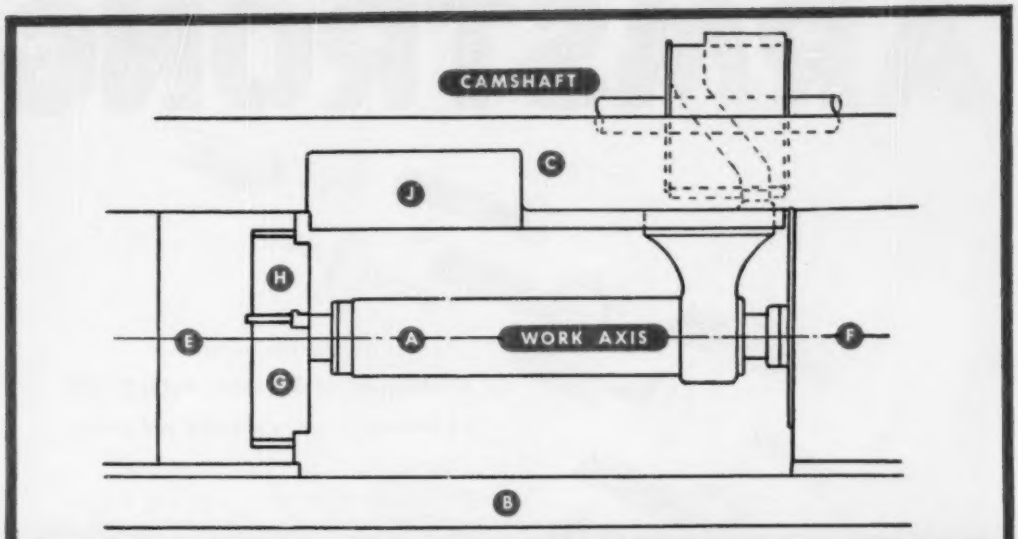
The completely automatic cycle of this machine is as follows: (1) Loading slide transfers parts from magazine to broaching position. (2) Broaches are automatically elevated through the work, work table, and into automatic pullers on machine ram. (3) Broaching stroke begins automatically. At the end of this stroke, parts are discharged from machine. Loading slide automatically returns to magazines to pick up more parts. (4) Machine slide automatically returns downward, disconnecting broaches. (5) Broaches are automatically lowered to starting position. Note: *All steps in the above cycle are electrically interlocked.*

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery



THE *good* THAT MEN DO

The horizontal design Tooling Area, shown above, is a contribution by Frank L. Cone to the improvement of the Multiple Spindle Automatic Bar Machine that will live long after him. The advantages, stated below, are made possible by the machine's Overhead Camshaft. Specific data invites comparison.

THE TOOLING AREA OF THE CONOMATIC (1½" Six Spindle):

1. **Handles longer work than can be handled by the tooling area of any other "automatic."**

   The length of the Tooling Area is 46⅛ ins., which permits standard machining operations on work up to 18 ins. in length from the face of the cut-off tool.

2. **Is more strongly supported by the machine frame than is the tooling area of any other "automatic."**

   The stocky Uprights, E and F, which are shorter than those of other "automatics," are securely bolted to — and held between — the Top Bed, C, and Base, B, which are larger and heavier than such members of other "automatics." *The Uprights are 22" high. The Top Bed is 8" high, 23" wide and 103¼" long. It weighs 1232 lbs. The Base is 33⅜" high, 46" wide and 110" long. It weighs 6655 lbs.*

3. **Provides more Tooling positions than does any other "automatic."**

   The Main End Slide, A, has 6 positions. The Main Cross Slides, G and H, front and rear, have 6, and the Auxiliary Cross Slide, J, front and rear, are 2 more, which make a total of 14.

Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

ARMSTRONG

Use the correct

ARMSTRONG TOOL HOLDERS

to increase pieces, production and profits.

Because they do their work so well, without repairs, maintenance or replacement . . . because they last for years and have become as much a part of everyday operations as steel itself, the importance of using the correct type and size ARMSTRONG TOOL HOLDER for each operation, is frequently overlooked. It should always be remembered that by controlling the cutting point, ARMSTRONG TOOLS control both the productivity and efficiency of every lathe, planer, slotter, and shaper in most shops.

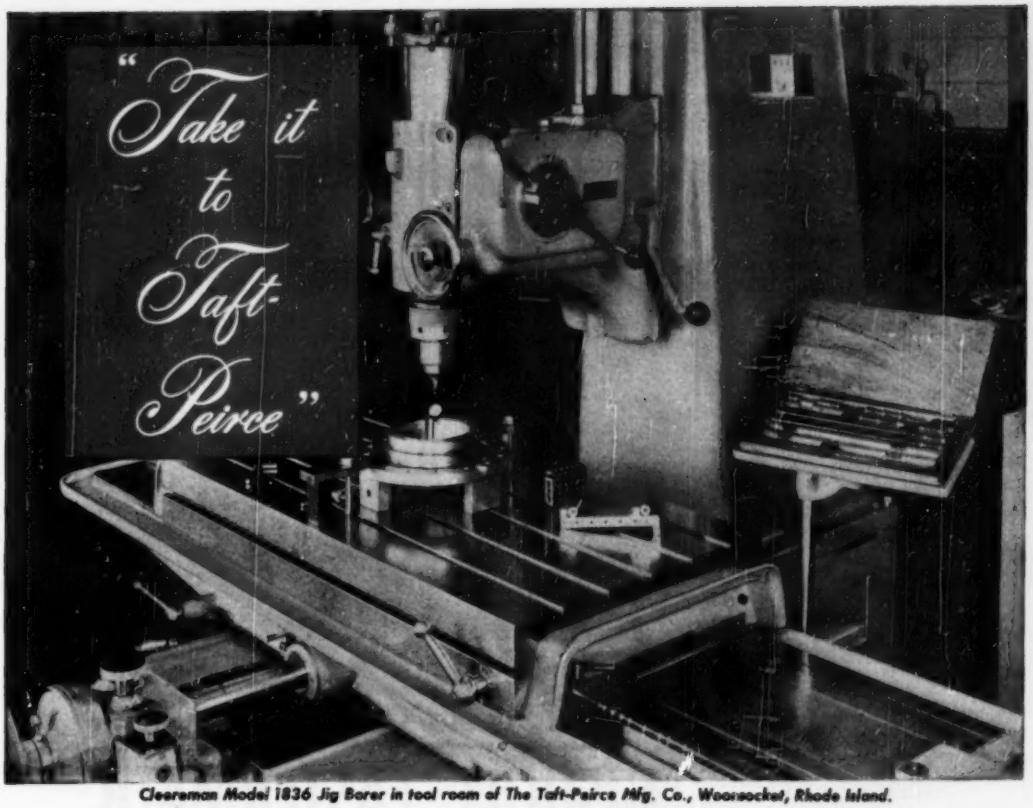
Tools so vitally situated, no matter how trouble-free, deserve periodic checking . . . checking to see that the correct size and correct type ARMSTRONG TOOL HOLDER is being used for each operation: checking to be sure that you are taking full advantage of the newer additions to the Armstrong System—the special types for ARMIDE (Carbide Tipped) Cutters, others for ARMALLOY (Cast Alloy) Bits and Blades; the newer "spring" form threading tools and cutting-off, etc., etc.

Write for a recent ARMSTRONG Catalog and check your tooling of each operation.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

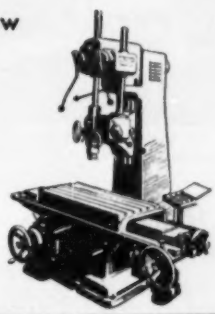


Cleereman Model 1836 Jig Borer in tool room of The Taft-Peirce Mfg. Co., Woonsocket, Rhode Island.

...where a CLEEREMAN JIG BORER

helps maintain this shop's world-wide reputation of unexcelled precision

Taft-Peirce world-wide reputation for accuracy and quality is based upon selected precision tools and the strict traditions of New England craftsmanship. Upwards of fourteen hundred machine tools of the latest and best types are available for every class of machine tool work.

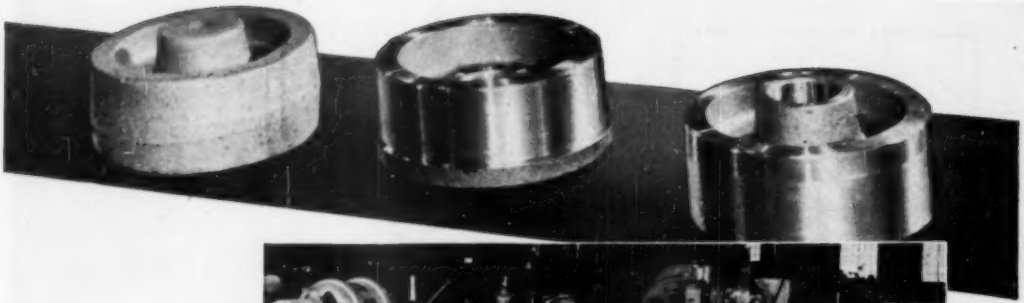


Cleereman Jig Borers are being installed by an increasing number of plants where, as is the case with Taft-Peirce, uncompromising accuracy is essential.

Affiliated with—

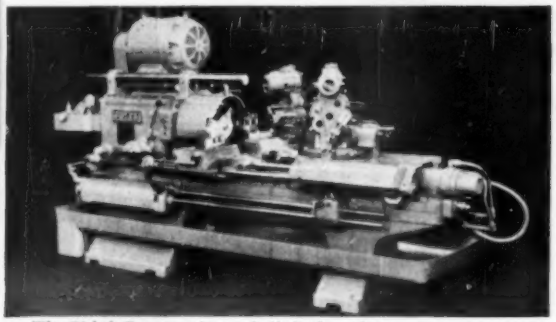
CLEEREMAN MACHINE TOOL CO. Green Bay, Wis.

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES



from 41.9 Minutes down to 15 Minutes

That's Productivity with the GISHOLT FASTERMATIC



The Gisholt Fastermatics are built in three sizes ranging from 21" to 36¼" swing over bed.

The cost of machining these gear blanks at the Falk Corp. took a sharp drop when the Fastermatics took over. Time was cut nearly two-thirds. Moreover, human errors were eliminated, thanks to Fastermatic's ability to hold close tolerances.

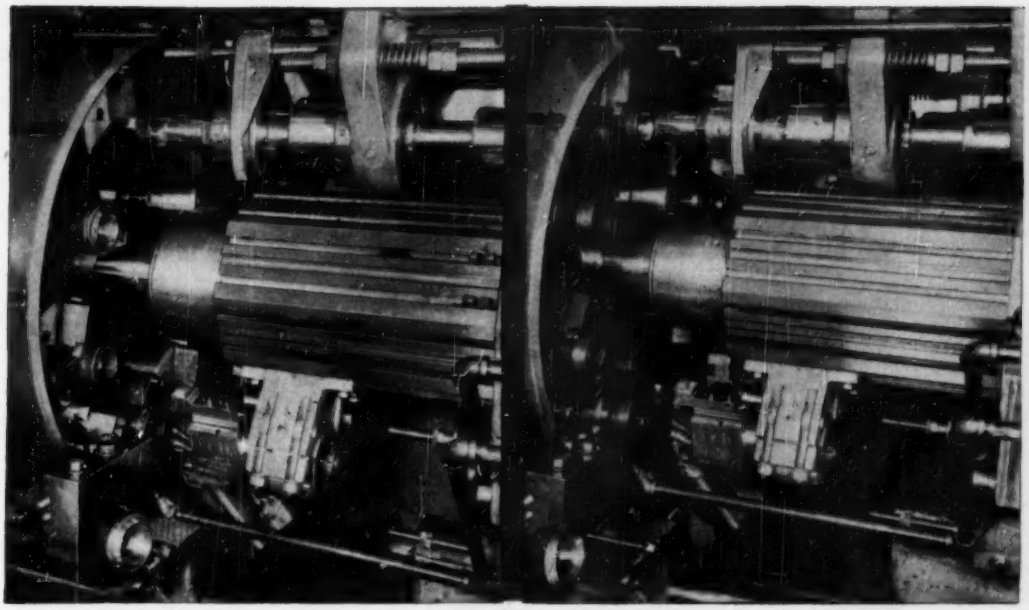
One operator tends 2 Fastermatics and a honing machine. Simple tooling makes it possible to handle 9 different sizes of gear blanks.

These modern automatic turret lathes enable you to handle a larger number of operations in one chucking—and cut costs to the bone on a wide variety of work. Ask for facts about them.

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



"INCREASED PRODUCTION—500%"

Here's a direct quotation from Catawissa Valve & Fitting Co., Catawissa, Pa.

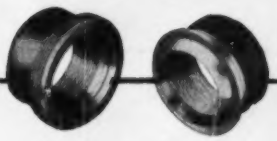
"Your 8" Model RPA-8 spindle Acme-Gridley Chucking Automatic, arranged for double index, has, as nearly as we can estimate, increased production in our plant 500%, on the work to which this machine has been assigned.

"In addition to this increase, we are obtaining a more uniform product than formerly when we moved the work from one machine to another. The operators also report that the ease of operation is considerable over the former method."

Such savings are not unusual for Acme-Gridley users—and here's why:

Sturdy frame construction; wide, open tooling zones, with plenty of room for timesaving power-driven auxiliaries; simple, direct camming—these and many other exclusive Acme-Gridley features all add up to *"More Good Pieces in the Pan at the End of the Day."*

May we show you how the modern, more versatile Acme-Gridley Automatics can increase production and cut costs in your shop?



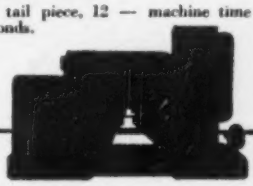
JOB FACTS

PARTS: Forged Steel 2" Pipe Union, head and tail pieces.

MACHINE: Acme-Gridley 8" RPA-8 Chucking Automatics arranged for Double Indexing to finish both ends of a piece in one setup.

OPERATIONS: On head piece, 13—machine time 31.5 seconds.

On tail piece, 12 — machine time 31.5 seconds.

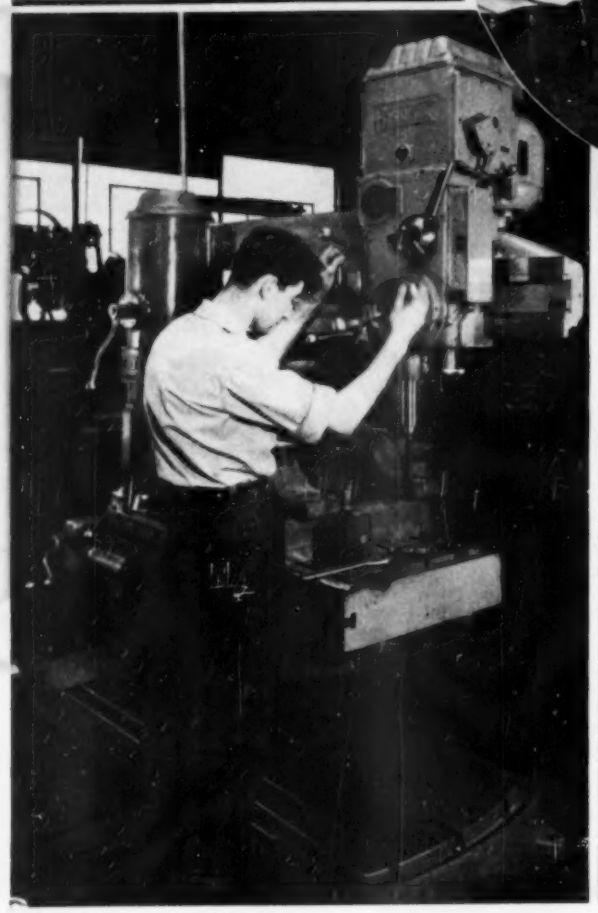


The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

It's easy to drill and tap various diameters ON THE FOSDICK *Sensitive* RADIAL



● Because of the unique design which combines sensitive drilling and the utility of radial construction in one machine the FOSDICK Sensitive Radial is proving a most convenient and cost saving machine tool.

For example, on the job shown a hole is being tapped on one section of the work and a small hole is being drilled on another section of the piece at the Bayer Machine Co. plant, Jackson, Michigan.

One of the outstanding features of this machine is the elevating table which is adjustable on the column. This insures locating the work in the proper position for the job at hand. Another advantage is the swing of the table and the arm in an arc of 360°.

Note, too, the arm at fixed height is easily reached from operator's normal position. The head of simple design provides nine speeds and four feeds. Control levers for both feeds and speeds are direct reading. Hence the operator has complete control at his fingertips.

On many of your jobs requiring sensitive drilling you will find it more economical to use a FOSDICK Sensitive Radial. For complete details write for the new FOSDICK Sensitive RADIAL Bulletin SRA.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

ORIGINAL

JOHANSSON GAGE BLOCKS (JO-BLOCKS) AND ACCESSORIES

. . . manufactured at the C. E. Johansson factory in Eskilstuna, Sweden are now available on the American market at prevailing prices.

Johansson Gage Blocks are the foundation for accuracy in the engineering industry. These gages are universally adopted in the industrial world due to their simple and practical usefulness together with their very great accuracy.

INSPECTION AND RECONDITIONING service available at our plant

AVAILABLE THROUGH

C. E. JOHANSSON GAGE CO.

8900 ALPINE AVE.
DETROIT 4, MICHIGAN

A DIVISION OF SWEDISH GAGE CO.

Van Keuren MEASURING WIRES

STANDARD EQUIPMENT...

...everywhere

Measuring the pitch diameter of a 1"-8 National Form thread gage. This method is recommended by the Bureau of Standards.

New New New

NEW CONCEPTIONS
NEW FORMULAS
NEW TABLES

for the exact measurement of multiple worms and screws of unknown profile.

The Fundamental Fact

The axis of a wire resting in a thread assumes a position tangent to the helix passed through the center of the wire and not the point of contact.

Van Keuren Measuring Wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. Reputable manufacturers of ground taps and thread gages used for the production and acceptance of threaded holes and nuts use Van Keuren Measuring Wires. You will seldom find them in error if you, too, have Van Keuren Measuring Wires.

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.

Set No. 20 Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

Price, High Speed Steel Wires ..... $ 95.00
Price, Carboloy Wires 240.00

Special wires from .002" to 2.000" diameter are made to any tolerance required.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

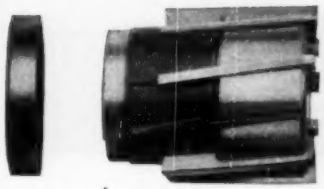
Select BARBER-COLMAN REAMERS FOR COST CONTROL and SIZE-FINISH CONTROL

ON-THE-JOB *Features*

LOW-COST BLADE REPLACEMENT

EASY SIZE ADJUSTMENT

CONTROLLED SIZE, STRAIGHTNESS, ROUNDNESS AND FINISH



All Extra Parts Eliminated. Pins and Wedges Hold Blades Solidly Against Body, Comparable to Solid Flute Design.

If you choose between accurate, quality reamed holes — and low-cost reamer maintenance and operation — you can have both by using Barber-Colman Adjustable Reamers.

Barber-Colman pin and wedge design provides more blades per reamer diameter for better cutting action. Blades are solidly held in perfect diameter, avoiding any possibility for variation in roundness or straightness. Size adjustments are easily and quickly made, with size readily checked across any two blades.

These features mean better and faster results, with less cost per hole machined. Ask Barber-Colman reamer engineers to assist on your reaming jobs, or send tool and part prints for recommendations.

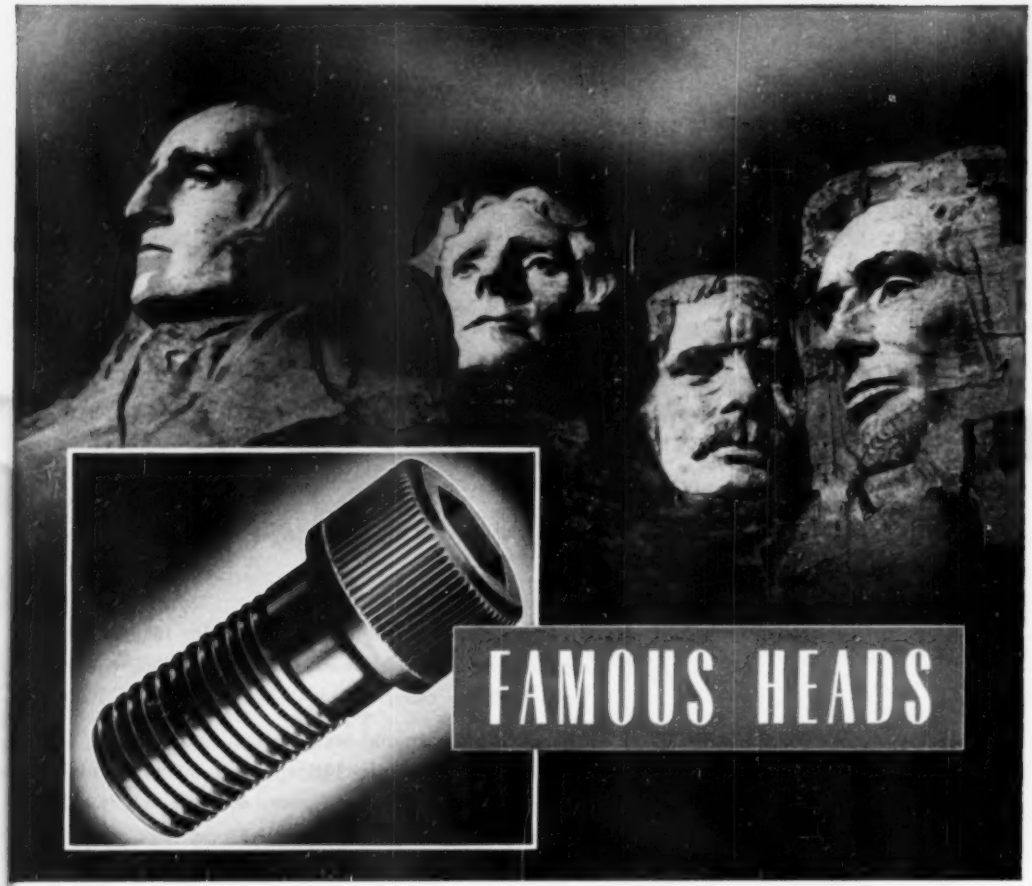
***Free* PRODUCTION DATA**

Current Case Histories of Reaming Jobs Taken Directly From the Field. Get a Set Today. Ask For File 9130.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 9130 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

BARBER COLMAN



The *knurling* on the head of the UNBRAKO Socket Head Cap Screw saves valuable assembly time because the UNBRAKO can be screwed in faster and further with the fingers—the handiest of all wrenches—before an actual wrench is needed. The slip-proof knurling "gears" the screw to the fingers, even when they are oily or greasy . . . which is especially important in the smaller sizes.

Knurling of Socket Screws originated with "Unbrako" in 1934.

Knurled Head Socket Cap Screws
Flat Head Socket Cap Screws
Self-Locking Socket Set Screws

SOCKET **UNBRAKO** SCREWS

Knurled Head Stripper Bolts
Precision-Ground Dowel Pins
Fully-Formed Pressure Plugs

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 1, PENNSYLVANIA

What an Appliance Maker learned from an Automotive Specialist about DIE CASTING...

BUILDING appliances was an old story to a well-known manufacturer but he knew the reputation of the automotive industry for getting quality products at low cost. He figured that any firm with the know-how to serve the car-making industry might be able to show him ways to improve quality and save money doing it. So when a rather unusual die casting and plating requirement came up, he got in touch with the Auto-Lite Die Casting Division. The result was an improved casting and a saving in money, too.

If you have a die casting requirement in which quality or price is a problem, or if you need the help of Auto-Lite's famous design and engineering experts, write to

THE ELECTRIC AUTO-LITE COMPANY

Die Casting Division

Woodstock, Illinois
600 So. Michigan Ave., Chicago 5, Illinois

Lockland, Ohio
723 New Center Bldg., Detroit 2, Michigan

AUTO-LITE

die castings
plastics
wire and cable
industrial
thermometers

Memo to all Forge Shops!

The best way to produce odd-shaped forgings is to pre-form the blanks in REDUCEROLLS and finish-forge them in MAXIPRESSES.

No. 4 REDUCEROLL

No. 6A MAXIPRES

THIS DOOR IS ALWAYS OPEN

We shall be pleased to assist you with your forging problems. Our entire organization is available to you. Send us blueprints or a sample of the part you wish to forge. Better yet, visit us. No obligation, of course.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

New York Detroit Chicago

New Townsend Tufflok Nut Is Tougher Three Ways To Give You Tighter Grip, Greater Safety, With Economy

You get a tighter grip, greater safety and economy with the new Townsend Tufflok nut. It gives you more service at less cost. The exclusive Tufflok design*, plus the materials in the insert and nut body combine to give you the toughest lock nut yet produced for any use where nuts must stay put under a variety of adverse conditions.

Here are the New Exclusive Features of the Townsend Tufflok Nut:

1. *Tough hexagon insert*—won't turn in its seat, gives you positive grip on the bolt at all times. Specially treated insert resists moisture, oil and drying out. Special inserts where special applications are required.
2. *Tough, one piece cold forged nut* has exclusive petal design to assure positive insert staking.
3. Tough threads *cut in cold forged steel* are stronger, spin on easier, resist galling, speed up application and also afford more reuse.

The quality, efficiency, and safety with economy, you get in the new Townsend Tufflok nut is made possible by the skill and experience gained by The Townsend Company as the oldest manufacturer of small cold formed fasteners in the United States. This know-how combined with the background of The Nylok Corporation in producing millions of lock nuts gives you the advantage of a reliable source for your lock nut requirements.

The new Townsend Tufflok nut with exclusive hexagonal treated insert and special cold forged body is available in machine screw sizes No. 4 through 3/8", cadmium or zinc plated. This line will be increased in the near future.

For longer service with greater safety and economy specify Townsend Tufflok Nuts. Write today for samples and complete information.

THE TOUGHEST LOCK NUT EVER PRODUCED

*Licensed under The Nylok Corporation patents. Tufflok is a trademark of the Townsend Company.

Call or write today to:

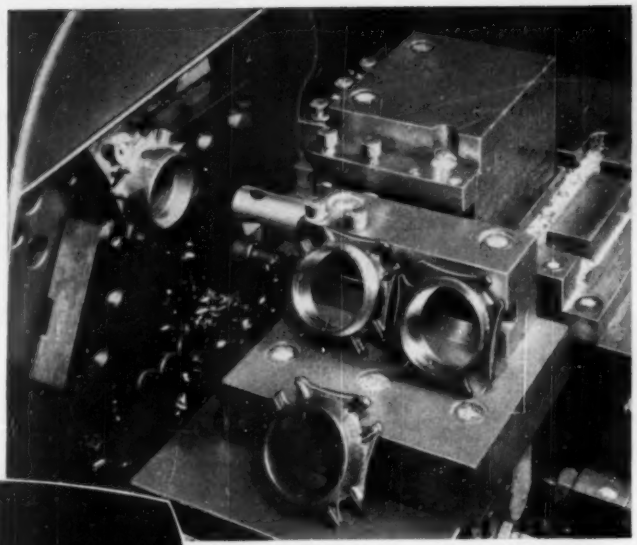
Townsend

COMPANY — ESTABLISHED 1816

New Brighton, Pa.

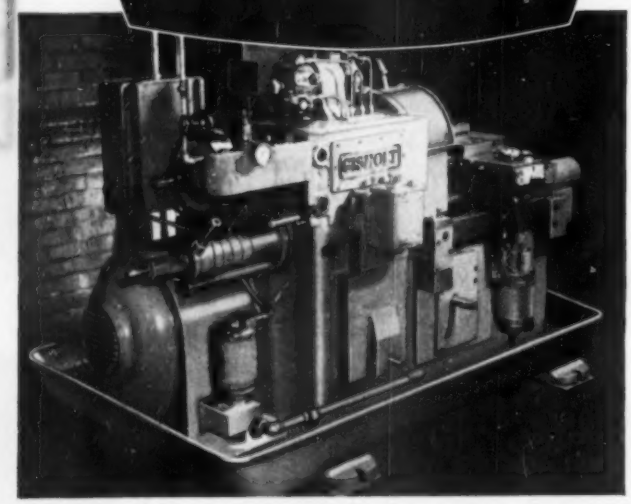
Chicago 38, Ill.

Small Job Shop Catches the BIG IDEA



cuts costs with—

GISHOLT No. 12 HYDRAULIC AUTOMATIC LATHE



No matter whether the shop is large or small . . . if there's volume, there's the opportunity to make money faster with automatic machining.

The Kilbourn Engineering Company of Milwaukee saw it—and proved it again—subcontracting these parts for electric hot water heaters with the Gisholt No. 12 Hydraulic.

Greater Production

With its fast automatic cycle and multiple cutting, the Gisholt turns out these parts at twice the rate of the previous method. A man merely loads and unloads the machine. The owner is not limited to this one job either. It is easily set up to handle a variety of work up to 12" in diameter.

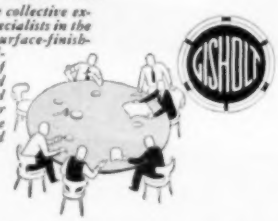
Corner for Profit

Such work can be highly profitable for job shops. Especially when the whole operation can be tucked into one small corner of the shop as this one is.

Progressive thinking like this is what makes many small shops grow into big ones. Gisholt engineers can help you with all kinds of ideas for making the most of machine tools.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

There's a Century MOTOR To Supply Dependable Power For All Popular Applications

Century motors are available in ratings from 1/6 to 400 horsepower, in a wide range of types and kinds—single phase and polyphase alternating current, and direct current. All of them are expertly built to assure top performance throughout a long service life.

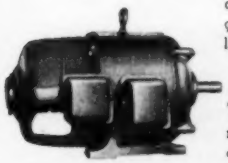
POLYPHASE

Type SC—OPEN PROTECTED—Form I, general purpose motor—meets the needs for most installations where operating conditions are relatively clean and dry. The top half of the motor frame is closed to keep out falling solids or dripping liquid.

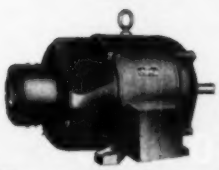
Type SC—SPLASH PROOF—gives the necessary protection where plants must be washed down—keeps water out of the motor even when a hose is applied directly on the frame. Also provides protection against rain, snow, sleet and ice for outdoor installations.

Type SC—TOTALLY ENCLOSED FAN COOLED—protects against dusts, mist or fog detrimental to the vital parts of the motor. The inner frame protecting the motor is sealed to keep out harmful matter.

Type SC—EXPLOSION PROOF protects against atmospheres charged with explosive dusts or gases. They carry Underwriters' label for specific kinds of hazards.



Type SR—SLIP RING—wound rotor motors are suitable for applications requiring low starting current with high starting torque, reversing, or adjustable speed.



Type SY—SYNCHRONOUS MOTORS—suitable for continuous operation at a uniform load for power factor correction.

SINGLE PHASE

Type RS—REPULSION START INDUCTION—single phase brush lifting motor suitable for applications requiring high starting torque with low starting current.

Type CSH—CAPACITOR START INDUCTION—single phase motor suitable when high starting torque with normal starting current is required.

Type SP—SPLIT PHASE, INDUCTION—single phase motors—suitable for light starting duty.

DIRECT CURRENT

Type DN—DIRECT CURRENT MOTORS—suitable for use where direct current is available or its use desirable.

These illustrations are typical of Century's complete line of motors. Others available include gear motors, generators, AC and DC motor generator sets.

Specify the right Century motor for all your electric power requirements.

Popular types of standard ratings are generally available from factory and branch office stocks.

CENTURY ELECTRIC COMPANY

1806 Pine Street
St. Louis 3, Missouri

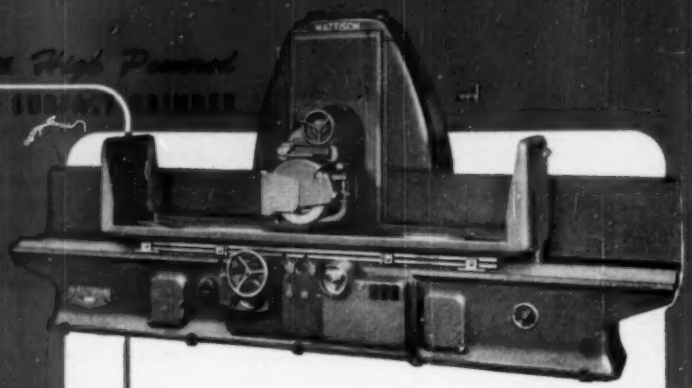
Century MOTORS

845

MATTISON GRINDERS

MATTISON *High Powered*
PRECISION SURFACE GRINDER

● With the addition of the production grinding machinery formerly made by the Hanchett Manufacturing Company, Mattison is now in a position to work with you on all your surface, face and disc grinding problems. These machines are made in various types to handle a wide range of work. Experienced fixture engineers are available to give you best production efficiency with Mattison Machines.



ROTARY AUTOMATIC No. 72

For further information on any of the Grinders listed, ask for free circulars containing complete specifications and operating data.

***Grinders now built by* MATTISON**

SURFACE GRINDERS: High-Powered, Precision, Horizontal Spindle —Rotary Type, Vertical Spindle— Rotary Automatics, Vertical Spindle — Reciprocating Table Type, Vertical Spindle — Plano Type, Horizontal and Vertical Spindle.

FACE GRINDERS: Traveling Table (Hydraulic) and Traveling Wheel.

DISC GRINDERS: Single Spindle, Double Spindle, Vertical Spindle, Automatic Single Wheel.

WAY GRINDERS: Vertical Spindle for dovetails and undercuts.

ABRASIVE-BELT GRINDING AND POLISHING MACHINES for wide steel sheets, strip steel, internal tube, etc.

● For years Mattison Machine Works has successfully built High-Powered Precision Surface Grinders and will continue to build the same high quality into the entire line — through sound principles of engineering, precision manufacturing, careful workmanship and modern methods of production. Our reputation for service and careful attention to machines in the field will naturally extend over the complete line of Grinders now built by Mattison.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

USERS *Recommend Highly*

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT DRILLING MACHINES

Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines

Equal Efficiency of Every Unit Makes the Balanced Machine

We have proven conclusively in our shop that this new SUPER SERVICE Precision Drilling Machine, when used with an automatic spacing table, saves money, time and labor by eliminating jigs, bushings and fixtures. This 36-speed, 18-feed, 10 HP Machine is well recommended. This typical statement was made by a user of one of these new machines:

> "The SUPER SERVICE Precision Drilling Machine is the best investment we have made for a long time. It is performing way beyond our expectations as to drilling time, precision work and overall savings."

Let us show you how your jobs can be economically processed on one of these machines.

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

toughen metal

improve surface

end stock waste

The Torrington Rotary Swaging Machine delivers 4000 hammer blows a minute...reduces, sizes, rounds, points and tapers rod, wire and tubing... work-hardens metal for toughness and resilience...produces a burnished surface... utilizes every bit of stock.

Torrington Swager performance is based on our 42 years of swaging experience. Send the coupon for your free copy of the booklet illustrating the machines and describing the art of rotary swaging.

THE TORRINGTON COMPANY
Swager Department
559 Field Street • Torrington, Conn.

For a free copy of this booklet, send the coupon today.

Please send a copy of "The Torrington Swaging Machine" to:

Name_____

Firm_____

Address_____

BACKLASH

Tryout for HS Machining

"Your article in March 6 *AM* ("Are Shopmen Scared of High-Speed Machining") has provided a lot of interesting discussion in the last few weeks. Our Production staff spent last Saturday morning discussing how to put this program into action. We have recently purchased a new 20-in. contour lathe. We are setting up our various parts on this lathe based on highest speeds and feeds that tools and machine will stand.

Do you have any suggestions of the rake angles suitable for turning 416 stainless steel and 8640 gear-blank steel?

This article is a most thought-provoking one, and it shows the most revolutionary thinking in machining that we have had for a long time.

C. A. Koepke
Vice-president,
Waterous Company

In the absence of detailed information, two experts in production lathe operations give these figures with which to start:

1. Tests on stainless 416 in a No. 5 J & L ram-type universal turret lathe gave 5/16-in. depth of cut on 1⅜-in. dia stock at 2000 rpm (720 sfpm) with 0.015-ipr feed. Roller backrest turner (rolls behind) and Lusol as coolant. Tool had 10° positive rake with ⅛-in. wide chip breaker about 0.010 in. deep and 5° clearance angles, EM or equivalent carbide. Finish on pieces was excellent, no trace of work hardness, tool still sharp after test.

On 8640, he suggests 700 and 900 sfpm as a starter with K3H carbide or equivalent, 7° negative side and back rakes and 7° clearances, feed 0.007 to 0.015 ipr, depending on power and conditions. Coolant should be used. 5° shallow negative chip breaker, of a width to be determined by depth of cut, may be necessary.

2. For turning 8640 steel, the second source suggests 2° to 3° side rake, and front and side clearance of 6° to 7° and a 3° land at the cutting edge. He also suggests chip breakers ground into the tool top at the same angle as the tool grind to a depth of 0.015 to 0.018 in. at a distance from the cutting edge depending on the feed and depth of cut. The minimum distance from the edge would probably be 1/16 in. He suggests the same angles for starting on the stainless except that the chip breaker would be ground to about 0.024 in. deep.

Argentine Metalworking

In general, the shops in the States may be much better equipped than ours here (in Argentina), and materials as well as tools are more available and probably of better quality than here. So you will find that my problems are often different from yours.

Another bad detail here is the acute difficulty of getting dollars, so we are in bad shape as regards to spare parts for our U. S. machines. You may wonder what Argentina is producing, but the fact is that conditions are quite different here than in the U. S.; especially in the matter of quantity production. You produce in much higher quantities, so more economical methods may be used; while our quantities are smaller, and therefore our methods are often antiquated.

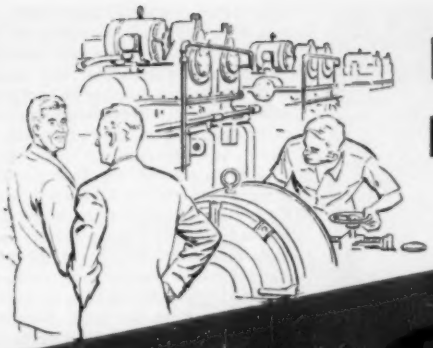
The same thing happens with books. With the large quantities of your editions, you can produce good books—well illustrated at low cost. In Argentina we are producing many books, but not well finished and not economically. For example; I am using the excellent *American Machinist Handbook* by Colvin and Stanley (McGraw-Hill). This book is cheap even in Argentina where we have a high exchange rate for U. S. dollars.

Sr. Ing. Pablo Redl
Buenos Aires
Argentina

Our Wool Slips Are Showing

In "How Steel Wool Is Made" (p. 102-104, May 15 *AM*), you say, "Steel-wool manufacturing is highly competitive, so much so that most machines are developed by the manufacturers, built under contract, never patented, and kept behind closed doors." As a matter of fact, the machines used by producers responsible for far more than half the total U.S. output have all been patented, and these patents contain many features protecting the machines, the validity of which has never been questioned in court.

With reference to the two general types of machines, you state, "Less widely used is a drum-type machine . . . Strands produced by this method are not as continuous as those cut by the shaving block; however, production is equivalent." My associate and I are probably the only living professional engineers



No wonder production men say . . .

"Delco Preferred!"

There's no better way to assure peak motor performance

- Positioned Bearings
- Delcote Coil Insulation
- Corrosive-Resistant Cast Iron Frame
- Positive Lubrication
- Dynamically-Balanced Rotor and Shaft Assembly
- Water-Tight Conduit Box

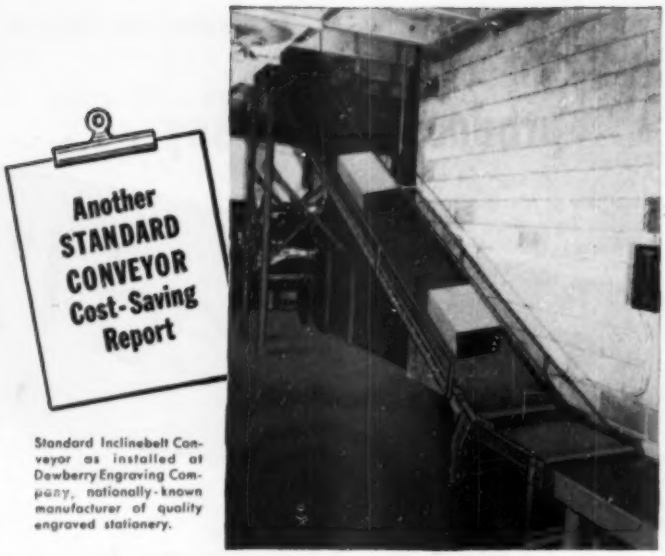
"Delco Preferred" . . . It's the engineers' and production men's way of saying, "On this job we want a fine quality motor that's sturdy, rugged, dependable . . . that outperforms all the rest!" Yes, when production men want to reduce motor maintenance and eliminate down time, they specify Delco—the only motor with all the *performance extras* listed at the left.

If you want to get all the facts on Delco Motors, call or write Delco Products, Dayton, Ohio . . . or contact any of the sales offices listed below.

DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.



Another STANDARD CONVEYOR Cost-Saving Report

Standard Inclinebelt Conveyor as installed at Dewberry Engraving Company, nationally-known manufacturer of quality engraved stationery.

Conveyor EARNS its ORIGINAL COST in First 3 Months

Dewberry Engraving Company, Birmingham, Alabama, nationally-known manufacturer of quality engraved stationery, writes us as follows:

"We installed one of your belt conveyors about two years ago. It has never required $1.00 in repairs and has worked perfectly every day. We operate 3 shifts, 24 hours a day and produce the largest quantity of engraved stationery in America. Your conveyor saved us its original cost in the first three months of operation. We have moved tremendous loads, far above the capacity you advise — without once stalling the conveyor. We do not see how we could operate without it."

Conveyors cut costs—speed operations — can do the same for you. Standard builds conveyors to handle "packages" of all types — bags, boxes, bundles, barrels, drums, cans, cases, cartons. Available in light, medium, or heavy-duty types — portable or stationary — systems, sections, self-contained units — power or gravity fed — yield remarkable savings in time, money and manpower.

Check your handling problem with Standard.

STANDARD CONVEYOR COMPANY
General Offices: North St. Paul 9, Minn.

Write for Standard's General Catalog No. AM-70. Tell us what you want to handle or type of conveyors on which you want information.

Standard
GRAVITY & POWER CONVEYORS

Engineered Conveyor Systems — Portable Conveyor Units — Spiral Chutes — Pneumatic Tube Systems

who have had the opportunity to run both types of machines in the same plant on the same raw material for many months under test conditions, including continued sampling and analyses by competent associates utilizing the best laboratory equipment and techniques. The finer strands produced on the machine referred to as "drum type" were many times longer than those produced on the "shaving block" type and freer from defects. In the very coarse grades, the strands produced by both types became more nearly similar, but in no way were the "drum type" strands inferior to the "shaving block." The production on the drum type is moreover, much greater. In addition, for more than two decades the drum-type machine has supplied a very substantial part of the entire steel-wool market.

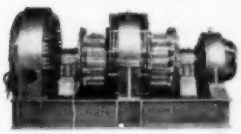
Next, you state, "The first efficient continuous (non-reversing), steel-wool machine was described in a patent application by Charles E. Galvin. This design, assigned to the International Steel Wool Company, solved the two problems which were preventing continuous production." This statement is simply not true, as I invented the first machine complying with the requirements stated, and anticipated Mr. Galvin by more than two years.

Under "Wire," may I point out that a very substantial percentage of the entire steel-wool wire requirement has in the past been supplied by the American Steel and Wire Company, which still is one of the two major producers. With respect to your statement about Acid Bessemer, Open Hearth Steel is used extensively for wool wire both abroad and in this country.

The cut in the lower part of page 104 has been extracted from a Restricted report that I made for the Engineer Board (Corps of Engineers, U.S. Army), during 1941 and 1942. This was a result of several years of research work to develop this then new and unique technique. I know you will want to give credit where it is due.

Under "Tools," your informant has stated certain specifications, which apparently cover one operating procedure, but do not cover several other successful operations. Since reading your article, I have reread my article on Steel Wool delivered before the Annual Meeting of the ASME in December, 1927. The principles I laid down 23 years ago still stand up.

Crosby Field
Consulting Engineer
Brooklyn 2, N. Y.



Never gamble on low-voltage generators. For trouble-free commutation, it *does* pay to look for fully-insulated brush holders and rigging . . . for a copper pigtail bar to eliminate current passage through springs and fingers, thus lengthening brush life. And for optimum commutator efficiency, you want copper graphite brushes; moulded-in "equaload" shunts for equal distribution of brush loads and reduction of resistance. All these "musts" for economical, dependable operation are built into H-VW-M Low-Voltage Generators. Ask for Bulletin G-102.

You have an ace in the hole when you make H-VW-M your central source for all accessory items. You save time, money, effort. Such supplies as rubber gloves, aprons, earthenware crocks, dipping baskets, etc., are essential but often overlooked until your stock is dangerously low. H-VW-M carries hundreds of these "widgets" in stock. Each of them is specially made to meet the requirements of the plating and polishing industry; each conforms to H-VW-M's standards of highest quality.

You play it close to the chest when you specify Copper Graphite Brushes for your generators. This special material means maximum brush wear and life, insures highest conductivity along the path of the current. You play it safe, too, when you look for moulded-in shunts. Moulding-in keeps resistance at the minimum and when moulded-in "equaload" shunts are provided, selective action is eliminated, current distribution to the brushes is equalized. These plus factors, inherent in H-VW-M Copper Graphite Brushes, are described in Bulletin G-102.

And you always play it safe when you remember... you can always get what you want from H-VW-M when you want it . . . H-VW-M products are strategically warehoused for prompt service and delivery . . . H-VW-M sales-engineers and laboratory technicians are always available for help in your production problems. It is this overall service and experience that have made H-VW-M *the central source of supply . . . for over 80 years . . . for all the needs* of the electroplating and polishing industry.

HANSON-VAN WINKLE-MUNNING COMPANY, Matawan N. J.
Plants at: Matawan, N. J. • Anderson, Indiana • *Sales Offices:* Anderson • Chicago • Cleveland • Dayton • Detroit • Grand Rapids Matawan • Milwaukee • New Haven • New York • Philadelphia Pittsburgh • Rochester • Springfield (Mass.) • Stratford (Conn.) • Utica

H-VW-M

SINCE 1870

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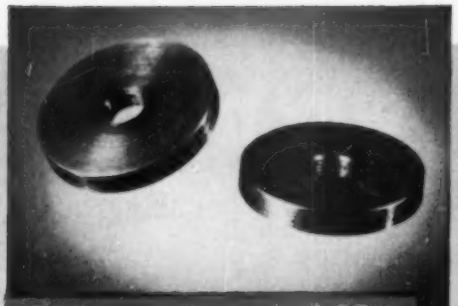
Manufacturers of a complete line of electroplating and polishing equipment and supplies

Want to cut costs on screw



Production Increased 27%

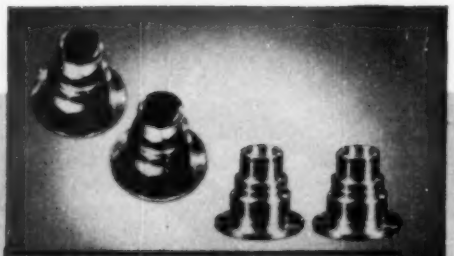
Grade:	MX
Size:	1 1/4" Round
Part Name:	Main gear polisher, movie projector
Machine:	1 1/2" Single Spindle Brown & Sharpe, G-2
Operations:	Drill, thread, broach, rough form, finished form, cut-off
Cutting Media:	Socony Vacuum All-Purpose. (3 to 4% sulfur added)

Comparative Production:

Grade	SFM	Seconds per part	Hourly Output Rate	Daily Output Rate*
B-1113		35	103	576
MX	312	27.5	131	736

*Based on 70% efficiency

Finish reported excellent and part tolerances very close. (Material furnished cold-drawn by Bliss & Laughlin, Inc.)



Production Increased 14% Longer Tool Life

Grade:	MX
Size:	.650" Round
Part Name:	Lift Pin for Automobile Window
Machine:	RA-6 Acme-Gridley
Operations:	Breakdown, rough form, shave, drill, cut-off
Coolant:	Paraffin oil

Comparative Production:

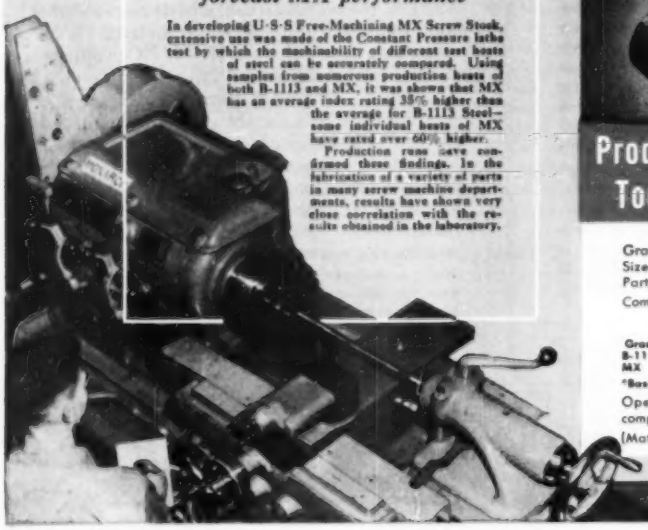
Grade	SFM	Seconds per part	Hourly Output Rate
B-1113	200	4	900
MX	220	3.5	1028

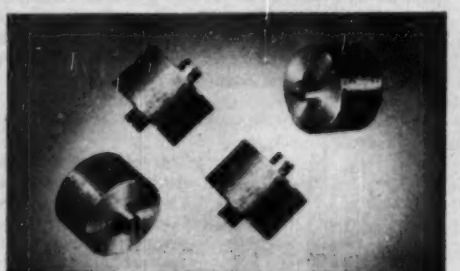
(Material cold-drawn by Pilgrim Drawn Steel Division, Automotive Materials Corp.)

Here, laboratory tests accurately forecast MX performance

In developing U-S-S Free-Machining MX Screw Stock, extensive use was made of the Constant Pressure lathe test by which the machinability of different test heats of steel can be accurately compared. Using samples from numerous production heats of both B-1113 and MX, it was shown that MX has an average index rating 35% higher than the average for B-1113 Steel—some individual heats of MX have rated over 60% higher.

Production runs have confirmed these findings. In the fabrication of a variety of parts in many screw machine departments, results have shown very close correlation with the results obtained in the laboratory.





Production Increased 66% Tool Life Increased 87%

Grade:	MX
Size:	3/8" Round
Part Name:	Roller

Comparative Production:

Grade	SFM	Seconds per part	Hourly Output Rate	Tool Life (Hrs.)	Tool Life (Parts*)	Tool Life Increase
B-1113	195	10	360	4	1008	
MX	260	6	600	7.5	3150	87%

*Based on 70% efficiency

Operator reports MX does not break off before cut-off is completed.

(Material furnished cold-drawn by Wyckoff Steel Co.)

machine parts ?

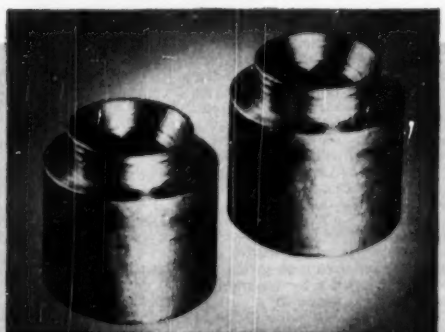
Do the job *faster* with MX

the new free-machining Bessemer screw stock!

"Nothing succeeds like success." Certainly this is true of U·S·S Free-Machining MX. As ever-increasing tonnages of this fast-cutting Bessemer bar stock are being put into production, shop after shop reports enthusiastically on its ability to outperform standard B-1113.

Here's what they say. "We've increased output 55%." . . . "No salvage necessary with MX." . . . "Finish is smoother and brighter." . . . "Tools last twice as long." . . . "Dimensions are more accurately maintained." No wonder MX Bar Stock has been called the finest product that has hit the screw machine field for years.

You can prove it for yourself by giving MX a thorough trial on your equipment. We think the results will convince you, too, that free-cutting MX is the most efficient, and the most economical Bessemer screw stock developed to date.



Production Increased 51%

Grade:	MX
Size:	1⅛" Round
Part Name:	Pulley Hub
Machine.	6-Spindle Conomatic 1¼"
Operations:	Rough form, finish form, drill, ream, countersink, spin, cut-off

Comparative Production:

Grade	Seconds per part	Hourly Output Rate
B-1113	23	157
MX	15	238

The improved deforming qualities of MX were used to advantage here in cold-crimping pulleys to hubs.
(Material furnished by LaSalle Steel Co.)

Even though MX costs slightly more than standard B-1113 it is actually cheaper to use MX because it can be cut at faster speeds—more parts can be cut between tool grinds—so that in the final count, *MX parts cost less per unit.* What is more, all the benefits that MX offers are in most cases obtainable without special cutting oils or special tool grinding.

MX has superior formability

The unusual ductility of this superior Bessemer screw stock, which permits faster machining and extends tool life, also gives MX the ability to perform exceptionally well under the severe stresses of deforming. In MX, the elasticity has been increased, with the result that it responds more readily than typical Bessemer grades to swaging, spinning, crimping and upsetting. It's a feature that makes for bigger output, fewer part failures.

• • •

MX is being produced in the popular bar sections and sizes. You can obtain it in cold-finished form from your regular supplier. In hot rolled bars MX is available through our nearest district sales office.

AMERICAN STEEL & WIRE COMPANY, CLEVELAND
CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Carnegie-Illinois Steel Corporation
Room 2153 Carnegie Bldg., Pittsburgh 30, Pa.

Please send me a copy of the MX Bulletin.

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Company.....

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USS

UNITED STATES STEEL

This quality feature is STANDARD construction on all-steel shank type

DANLY DIE SETS

DANLY INTEGRAL WELDED SHANK

A new welding technique that assures 100% fusion of shank to punch holder makes this superior construction possible. Knock out holes in the shank itself or machining on the punch holder face are much less likely to effect shank strength.

Features like this make Danly the nation's leading die set producer. Check these other Danly Die Set advantages and you'll see why die makers and production men everywhere prefer Danly Die Sets:

- *prompt delivery* . . . from the nearest of the nation wide system of Danly assembly branches.
- *precision construction* . . . leader pins and bushings hardened and ground to precision tolerances and lapped after assembly to provide a smooth running fit.
- *broad selection* . . . the wide range of Danly standard and stocked special die sets meets nearly every tooling need.
- *Danly reliability* . . . every Danly Die Set is backed by the experience accumulated in more than a quarter century of service to the stamping industry.

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2100 South Laramie Avenue, Chicago 50, Illinois

PRECISION DIE SETS . . . STANDARD AND SPECIAL

WHICH DANLY BRANCH IS CLOSEST TO YOU?

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SPOT NEWS of Metalworking

- **Steel industry could convert to war production almost overnight** if it needed to, head of major steel company reveals. Most of special equipment installed in World War II to convert sheet to plate production is either still in place in sheet mills or in storage nearby.

- **Ordnance Dept. has placed an order with Willys-Overland Motors for 8350 Jeeps,** aggregate cost of which will be $22,291,330. Order nearly doubles one placed in June, 1949, when Willys was asked to supply more than 4000 Jeeps and parts for the Army at a cost of $12 million. The new model Jeeps can ford streams while completely submerged.

Aluminum water-cooled cylinder block made from coreless castings brazed together has been developed by one automobile manufacturer. Strips of a brazing compound, melting point of which is about 200F below that of aluminum, are used in joining the castings together.

- **Taxpayers will have to pay bigger share of any future war than last time.** At peak of World War II Treasury was only taking in $45 billion a year. Figure being talked for possible third World War is something over $80 billion a year.

- **Large orders for motor trucks placed recently are ascribed to end-of-fiscal-year buying** rather than to Korean situation. Reo, Studebaker and International Harvester were among recipients (See "Detroit," p83).

- **New anti-tank weapon Vannever Bush mentioned recently** as ready for production is an oversize, smooth-bore bazooka firing finned "squash-heads." They "kill" armored vehicles with shock waves transmitted through the steel without piercing it.

- **Shift from demand for more paid holidays and larger pensions to higher hourly wage rates** is noted in some labor negotiations for new contracts. Reason: Union leaders sense a "pay freeze" in case Washington orders much war production.

Automobile crankshaft parts are being made experimentally on a Maxipres and butt-welded together by induction heat and pressure. Significant saving in steel results. Crank pins are forged hollow. Main journals and pins are ground without previous turning. Balance is good because there is no draft on crank cheeks.

- **Douglas has been awarded an $8 million contract to recondition B-26 attack bombers** at its Long Beach, Calif., plant. Douglas built some 2500 of the twin-engined ships, formerly designated A-26, between 1943 and 1946. Engineering staff is currently working at various western mothball bases selecting aircraft which require least overhaul.

- **Hungary was largest export buyer and Czechoslovakia second largest** of west German built machine tools and rolling-mill equipment during 1949. These shipments behind the Iron Curtain were approved by U.S. military government in Germany, despite fact Washington will not permit U.S. machinery builders to ship to those countries.

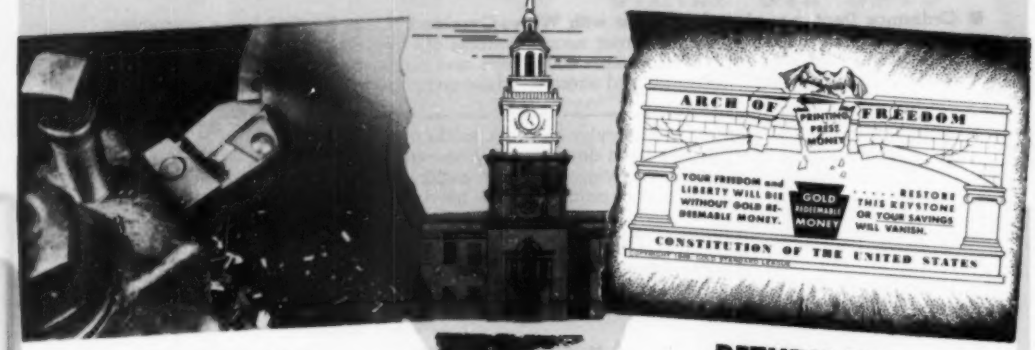
- **Electronic computer will take the work out of time-study figuring** for production planning. Basic data are fed into tube circuit from work slips and the machine runs through all operations and normal waits synthetically.

- **A new plastic pipe weighs only 61 lb per 100 ft in 2-in. diameters,** stands internal pressures up to 260 psi, and operates at temperatures up to 140F.

- **Oldsmobile has earmarked several million dollars for enlargement and rehabilitation** at Lansing, including a 2-story addition to the paint department for more paint booths, new plant engineering shops for sheet metal work, machine repair, etc.; added facilities for axle production, including materials handling equipment, conveyors, and numerous new machines.

- **Nash Motors is nearing completion of production prototypes of its experimental** $1000 NXI car. While withholding decision to put it into production, Nash is going ahead with engineering to the point of tooling and production.

HOW TO ACHIEVE *Economic* FREEDOM


ARCH OF FREEDOM
PRINTING PRESS MONEY
YOUR FREEDOM and LIBERTY WILL DIE WITHOUT GOLD REDEEMABLE MONEY.
GOLD REDEEMABLE MONEY
. . . . RESTORE THIS KEYSTONE OR YOUR SAVINGS WILL VANISH.
CONSTITUTION OF THE UNITED STATES

TURN TO KENNAMETAL

Kennametal Tools afford freedom from the economic worry of uncertain production costs, and help you get orders out on time. They save downtime . . . idle time for machines and men . . . because they take hard punishment without failure, because they machine more pieces between grinds, because with Kennametal clamped-in and indexable inserts a new cutting edge is ready without removing the tool from the machine.

Kennametal means faster machining of sandy castings, hard steel, on interrupted cuts . . . on non-ferrous metals and non-metallic materials. Kennametal is uniform in texture, always true to grade, as consistently dependable as gold itself.

RETURN TO GOLD COIN STANDARD

A Gold Coin Standard is to our national economy what Kennametal is to the metal working industries. Its quality is uniform and fixed, its value constant and dependable.

Unredeemable money is never constant in value, its quality is unknown and shifting from day to day.

When you borrow gold and repay gold, nobody is cheated. When you borrow paper and repay in paper somebody is always cheated.

Without a gold standard the future is always fogged with uncertainty. A managed currency is the chief instrument of governments that seek to manage the entire national economy. With a gold standard you can plan for the future, in your business, for yourself, for your family . . . you can enjoy again the almost forgotten security of Economic Freedom.

YOU GET MORE from Less Kennametal

Ask our representatives to demonstrate Kennametal . . . the tooling that reduces costs and increases productivity.

KENNAMETAL®
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc. LATROBE PA

YOU GET LESS from More paper money

Ask your Congressman if he is for or against the Reed Bill HR3262. You and other voters must know.

Washington

New money President Truman asked Congress to appropriate last week for financing the present half-war doesn't mean a big spurt in defense contracts right away.

Exception is quartermaster supplies like food, clothing, shoes, tents. These will be needed to supply larger number of troops under arms as a result of the draft and reserve calls.

Much of the new money will be used to activate things like planes, ships, tanks, guns now in moth-balls. That means spare parts orders.

First effect of Korea on industry will be a speed-up in deliveries under contracts already let.

Buying under the 1951 budget will come quicker than it did in 1950. For one reason, Congress will appropriate the money sooner than it did last year. Also, some contract letting will be expedited.

There'll be more requests for additional money later. Last week's figure is just a starter. Defense Department estimates of possible final cost of Korea alone run as high as $5-billion.

• • •

This half-war caught U. S. planners off-guard. They figured on either a long cold war or total atomic war much later. Little thought was given to anything in between. Officials are still adjusting.

• • •

Economic mobilization isn't planned immediately. Things like price and wage freezes, profit ceilings, manpower drafts, forced plant expansion, will come slowly and later rather than sooner.

Priorities and allocations—especially in steel—are exceptions, however. A delivery speed-up in present defense contracts requires some controls. The draft act gives the president priority and allocation control.

• • •

Don't sell new U. S. weapons developments short because of initial setbacks in Korea. U. S. troops were outnumbered 15-to-1, and the only "new weapon" there in the first two weeks was communications equipment, and not much of that.

• • •

If rocket-firing planes are to keep on fighting tanks, look for shaped charges and squashheads to be used as rocket warheads. Pilots reported standard HE warheads "bounced" off 60 ton Soviet tanks in Korea.

• • •

No refunds of tax penalties or interest will be made by BIR to companies whose liabilities are wiped out by loss carry-overs. BIR's reason: Penalties were imposed when taxes were still legally owed.

Taft-Hartley now applies to small machine tool plants if the tools and dies they produce are, "to a considerable extent, essential to manufacturing enterprises engaged in interstate commerce"—NLRB in granting CIO Steelworkers an election request at the Beaver Machine and Tool Co., Syracuse, N. Y.

New ruling reverses Board's attitude of a year ago when it turned down similar requests by unions at Screw Machine Products Co., Denver, and Tower Tool and Die Co., Detroit, who sold 95% of their products within the state.

• • •

Exhibition and manufacture of goods in foreign trade zones—bonded (duty-free) warehouses—is now legal. Until the new law this month, inspection, manipulation, repackaging, and sorting were the limit of what importers could do to goods in the zones. There are now six U. S. foreign trade zones.

• • •

First federal grant to a state for the study of industrial cancer was made last month, $35,000 to the Pennsylvania Department of Health.

• • •

Engineers claim 1954 is the soonest U. S. can expect to get a jet airliner into commercial service. That's if construction is started now.

First U. S. bid will probably come from Boeing Airplane Co., now ready to run wind tunnel tests on models of a 560 mph, 60-passenger four engine turbojet.

Meanwhile, first commercial British jet goes into service next year. Canada's Avro jetliner will try for—probably win—U. S. certification soon.

• • •

The $25-million needed to put 134 high-priority reserve merchant ships into "ready status," stands a good chance of getting Congressional approval. Need for troop and hospital ships and tenders is emphasized by Korean war.

Defense chiefs hope it isn't too late to bring back some of the shipyard labor force—now down to 35,000—needed to do the job.

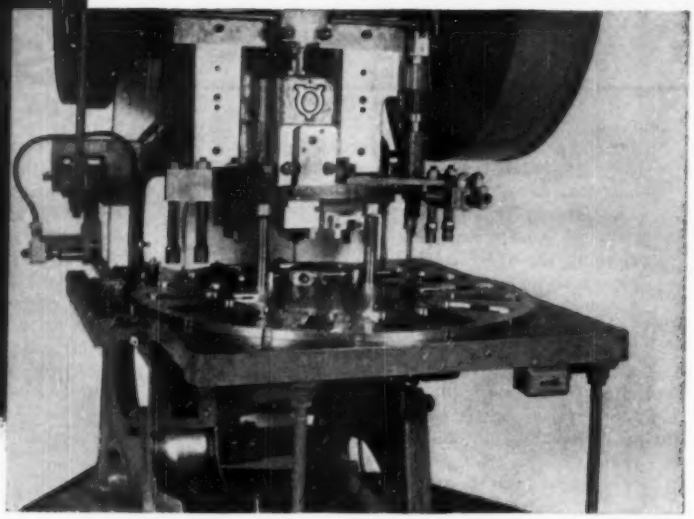
• • •

Copper's importance as a strategic material assures extension of the 2-cents-a-pound tariff suspension. House Ways and Means Committee has already approved another year of the moratorium.

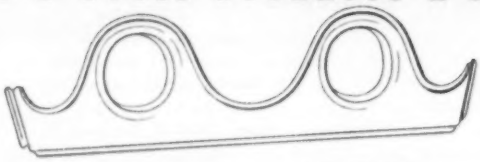
• • •

Chances were bad for a tax bill even before Treasury Secretary Snyder asked Congress to "wait and see" what happened in Korea. Now the only tax change you're likely to see is an increase—later in the year, when the real cost of the present situation is actually known.

With 3 Operations Combined Into 1...



a V & O Press Produces a Part Like This



The transparent tape dispenser part, shown at left, is produced on a V & O Press—with all operations performed automatically.

At the Rate of 55 Pieces Per Minute!

Ordinarily, it would require 3 different operations to produce the transparent tape dispenser part illustrated.

However, through the use of a V & O Press, equipped with a 16-station dial feed, all 3 necessary operations are **combined into 1!**

At the **first station** of the press, two holes are pierced and flanged, the outside edge is turned and ends are finished formed. The part is then indexed automatically to the **second station** where the recess is formed around the holes and the edge is brought up for the curl. At the **third station** the recess around the holes is set and the outside edge of the part is curled over. The part is ejected automatically. Output is at the rate of 55 pieces per minute!

The press — equipped with micro switch checking devices — stops automatically if more than one blank is fed, or if the part is not properly stripped from the punches. A cam operated safety-stop clutch permits the press to operate only when the dial is in perfect register.

Perhaps the solution to your stamping problem can also be found in V & O Press engineering. Write for details — or better still — let us arrange to have one of our sales engineers call at your convenience.

the V&O PRESS CO.
DIVISION OF ROCKWELL MANUFACTURING CO.
...Hudson, New York

Detroit

The Korean situation hasn't meant any significant new activity on the manufacturing side so far as Detroit is concerned—not for armaments, at least.

The one notable effect, manufacturingwise, was an amplified demand for automobiles. Nobody wanted to get caught short. Already moving to showrooms in heartening and optimistic numbers, car owners drifted in even faster—and called for quickest possible deliveries. The seasonal June-July sag was more than outbalanced by this demand—and August will be also. Some thinking now: There won't be any sag at all for the balance of this year.

One other satellite effect of the Korean crisis was the letting go of numerous civilian tooling programs which had been dangling in midair. Civilian goods companies wanted, apparently, to take no chances on getting behind any outcoming block of military orders. The 1951 automobile model modifications were drifting rapidly into the shops during early June. There were no major styling programs out, but enough changing to ensure a busy period ahead for the dieshops.

• • •

More important dollarwise than this kind of tooling are the releases coming out right and left from the engineering laboratories of Chrysler Corp. The long-awaited V engines of that company finally appear to be a fact, not a gleam in the eye of the development people. Built to high compression standards, the powerplant will appear in both 6- and 8-cylinder versions, on Chrysler, DeSoto, and Dodge. Nothing yet out for Plymouth.

• • •

Up at Flint, meanwhile, the machinery salesmen are sitting—as they have sat before—in the purchasing anterooms at Buick, waiting for releases. Buick like Chrysler, had a large-scale program on tap; like Chrysler, too it hadn't let go of it. Best word now: "Pretty soon—definitely soon." Once that engine job gets out, only Chevrolet and Pontiac in the GM line will be powered with prewar engines. Don't look for 1951 model devolpments from those quarters, though.

• • •

Out at Ford the planning is more definite, though actual releases may be farther off. New engines are definitely scheduled for 1951 models, but it is not sure yet whether that will be on one nameplate, or on more or all of them—Ford, Mercury, Lincoln.

• • •

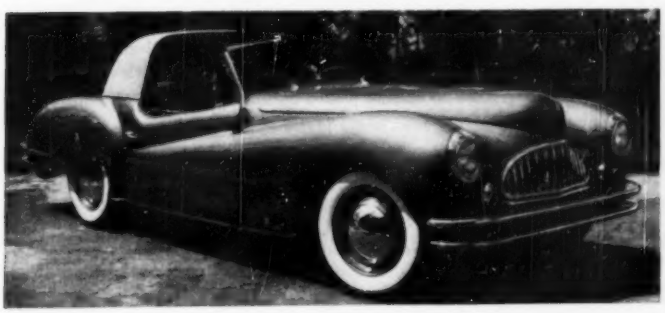
In some quarters, meanwhile, the Korean flareup has created widespread uncertainties and worries. These quarters are the ones which have had plans afoot to start this fall or winter on enlarged facilities. Said one highly-placed official of an automobile company: "Take that stamping operation we're in the middle of. Why should we install a lot of presses next fall and winter if we no sooner get them down then we have to rip them out and fill up the foundations with concrete?"

• • •

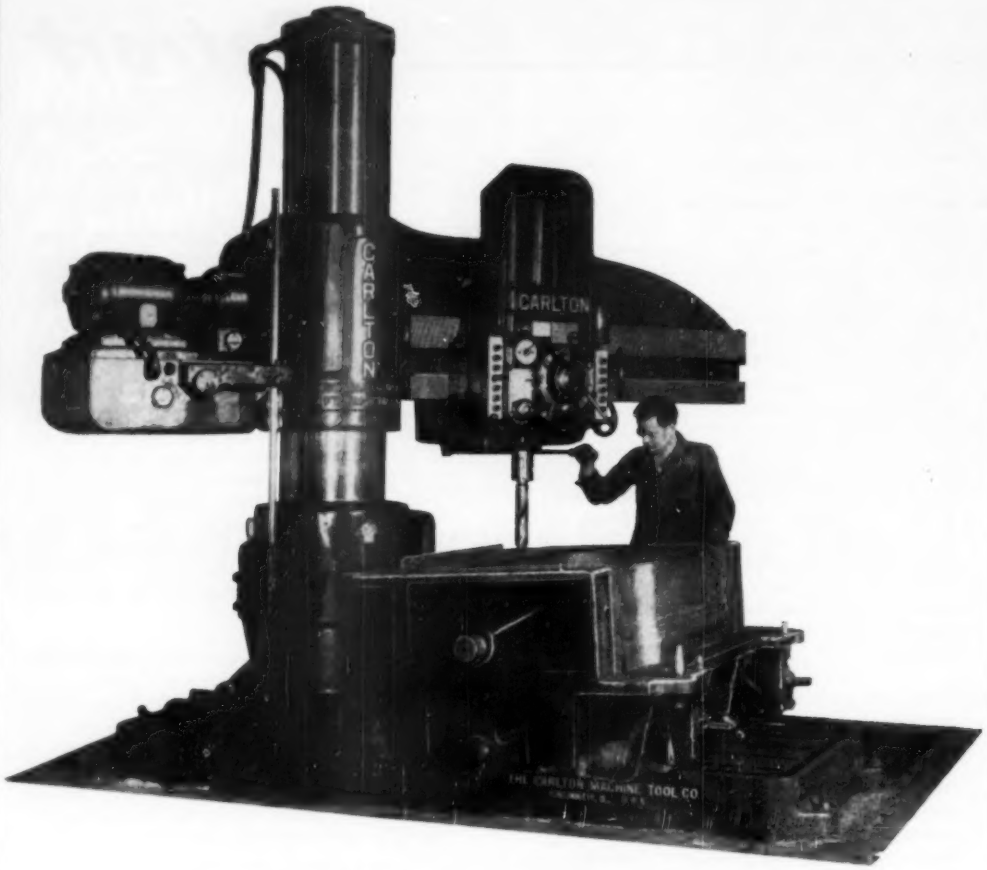
More tooling may be in order at Reo Motors, Inc., Lansing, as a result of recent increases in its Army ordnance business. The government signed a new contract for manufacture of 3900 "Eager Beaver" 2½-ton six by six trucks, in addition to 5000 already contracted for. Also, Reo is furnishing Studebaker with engines, cabs, sheet metal and parts for assembly of another 4000 2½-ton jobs.

• • •

Reo Motors is diversifying further. It has purchased the equipment and assets of Velo King, Inc., Canandaigua, New York, manufacturer of children's velocipedes. Plans have not been announced beyond the fact that fixtures and machines will be moved to Lansing, but the indication is that Reo will manufacture stamped toys which will supplement its line of lawn mowers and be distributed through identical channels.



MEXICO'S FIRST AUTOMOBILES turned out by DM Nacional last fall brought such a response of requests for the hand-made cars that the firm has expanded operations. Still building on a Mercury frame with Mercury engine, Nacional turns out cars, like this convertible with built-in bar, selling for 36,000 pesos (slightly over $4000) complete. DM Nacional will put this body or a choice of others on a customer's own car for 18,000 pesos (about $2000)



Carlton Radials

are National Favorites

All over the country you'll find Carlton Radials the favorite drilling machines. For example, the 6-ft arm 19-in column Carlton shown above—at the American Radiator & Standard Sanitary Corporation, Richmond, California—has saved many hours and turns out work of dependable accuracy. This Carlton — with fully automatic electric control by push button from head—is used for drilling holes and locating pins in bathtub molding machine requiring close precision.

Yes, Carlton Radials are delivering outstanding service in manufacturing plants, railroad shops, shipyards and steel mills all over the country. Carlton all-ball-bearing construction with the exclusive low-hung drive to spindle makes operation smooth and vibrationless even under heavy loads. For greater production, greater economy and satisfaction . . . investigate Carlton Radials today!

THE CARLTON MACHINE TOOL CO., Cincinnati 25, Ohio

New Tooling

June machine tool orders surpassed those in May, setting a new postwar record. The gain was without benefit of war orders. Both domestic and foreign sales were up. A healthy upturn in production also took place last month.

Business in June doubled the May volume in several cases. Automotive engine and transmission retooling accounts for biggest single chunk of orders, but demand has been good from tractor, business machines and other sources.

Some makers of special-purpose machines are booked well into first quarter of 1951. One prominent company is in this favorable spot even though it is working 12-hour shifts, having upped its schedule recently from 10 hours. Another builder of "specials" is avoiding much overtime by long delivery promises. It is booked through next April.

Many machine tool companies report excellent business thus far in July, which won't be too far below the June level. Certain customers, however, have delayed placing orders until they resume operations after vacation shutdowns.

• • •

Mechanical press builders are having the same happy experience as machine tool companies. June sales jumped sharply above the May volume. In one case, last month's gain amounted to 50%.

The press people say that July will be a big month too. Many companies are working two full shifts. At least one builder is on three shifts.

• • •

There is no evidence in Washington at this time that machine tools in sizable numbers will be ordered for war production purposes. The Korean war is not of sufficient scope to warrant such orders, unless suddenly the armed forces should wish tooling for output of a new weapon. Only in case of war mobilization on a large scale will machine tools be required.

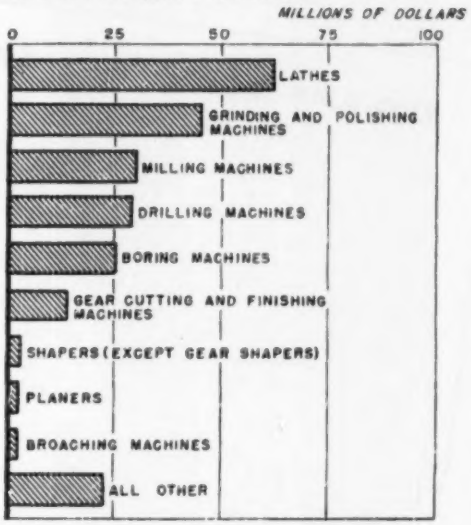
• • •

Still on the back of the shelf are so-called phantom orders for $750 million of machine tools, $125 million of cutting tools and $20 million of gages. These can be activated overnight, the plan being that the government will enable machine tool builders, for instance, to receive in cash 30% of the dollar value of their orders within a matter of days after the "go-ahead" is received from NSRB officials in Washington. The cash will enable builders to finance speedy expansion of operations.

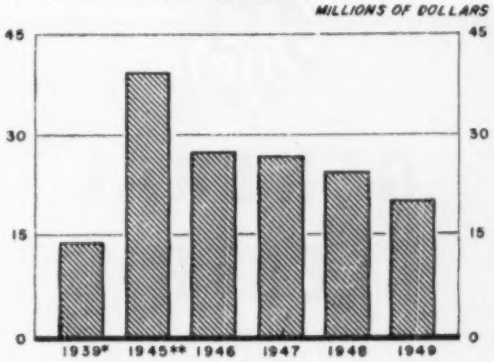
It would take 15 to 18 months to produce 100,000 machine tools for which phantom orders are outstanding. Some builders however might be able to complete deliveries within one year.

Lack of manpower and shortage of plants would be greatest handicap in getting machine tool production going. While number of trained men over-all is about same as five years ago, they are mostly in other industries and in places where they could hardly be reached by manpower controls. Machine tool industry has shrunk physically too, with 38 companies having quit or merged with others since 1945.

1949 Machine Tool Shipments Valued at $241 Million



Average Monthly Value of Shipments of Machine Tools: 1939, 1945-1949



*Data for 1939 represent value of production.
**Data for 1945 are for January-July only.

2 New

Automatic "Hot-start" Control for Instant Arc Striking

*

G-E Silicone Insulation for Compactness,

New Model 6WK20H 200-amp a-c welder

200-AMP MODEL — $180†

Weighs 154 lbs.

This little welder gives you more welding amps per pound—and more value for your welding dollar than any other standard a-c welder available today. And it's still a hard-working industrial welder with a current range from 30 to 250 amps, ($\frac{1}{16}$"—$\frac{3}{16}$" electrodes) 30 volts, and 50% rated duty cycle.

23" high, 12" wide, and 17" deep, it's easily carried about, or tucked away in spaces too small for bulkier units. Its fully automatic "hot-start" gives instant arc striking on any current setting with no manual adjustment needed. Maintenance is easy and inexpensive, and you can weld many a job without having to tie up large units. Write your distributor for bulletin GEC-553.

†List price for zone 1 (eastern); prices slightly higher in zones 2, 3, 4.

GENERAL ELECTRIC

211-11

ALABAMA—Young & Vann Supply Co. Box 2532, Birmingham; Turner Supply Co. Box 1429, Mobile
ARIZONA—Arizona Welding Equipment Co. 230 S. Central, Phoenix
CALIFORNIA—Victor Equipment Co. 844 Folsom, San Francisco
COLORADO—Hendrie & Bolthoff Co. 1635 17th St. Denver (also WYO.)
FLORIDA—Cameron & Barkley Co. 605 E. Forsyth, Jacksonville
GEORGIA—Welding Supply & Service Co. 295 Techwood Dr. NW, Atlanta; Georgia Oxygen Co. Box 1077, Macon
IDAHO—Olson Manufacturing Co. 4000 Warm Springs Ave., Boise
ILLINOIS—Machinery & Welder Corp. 1324 W. Fulton, Chicago (also IOWA)
INDIANA—Drill Master Supply Co. 1305 First Ave. Evansville; Sutton-Garten Co. 401 W. Vermont, Indianapolis; Perry Welding Sales & Service, 424 E. Monroe, South Bend
KANSAS—Watkins, Inc. 204 N. Waco, Wichita
KENTUCKY—G-E Supply Corp., Hoskins St., Harlan; Mine Service Co., Lothair; Reliable Welding Co. 630 S. 15th, Louisville; Big Sandy Electric & Supply Co., Pikeville
LOUISIANA—Equitable Equipment Co. 410 Camp, New Orleans; Hughes Welding Supply Co. 415 Fortson, Shreveport
MARYLAND—Arcway Equipment Co. 920 E. Fort Ave. Baltimore (also DEL.)
MASSACHUSETTS—General Electric Welding Sales, 9 Putnam St., Fitchburg (also MAINE, VERMONT, NEW HAMPSHIRE); Welding Engineering Sales Corp. 150 Causeway, Boston

a-c welders

Long Life, Light Weight

New Model 6WK30J 300-amp a-c welder

300-AMP MODEL — $310†

35" high; weighs 325 lbs.

For heavier-duty applications, this model handles $\frac{3}{32}$" to $\frac{1}{4}$" electrodes (current range 40 to 375 amps), is rated at 40 volts with a 60% duty cycle. Only 19" in diameter, it's really a miser on floor space.

Excellent arc-striking characteristics (automatic "hot-start," of course) and elimination of popouts means faster welding, sounder welds, and lower operating costs. Its job range, running from light-duty, low-current sheet metal jobs to heavy-duty, high-current applications, make it an excellent all-around, general-purpose welder.

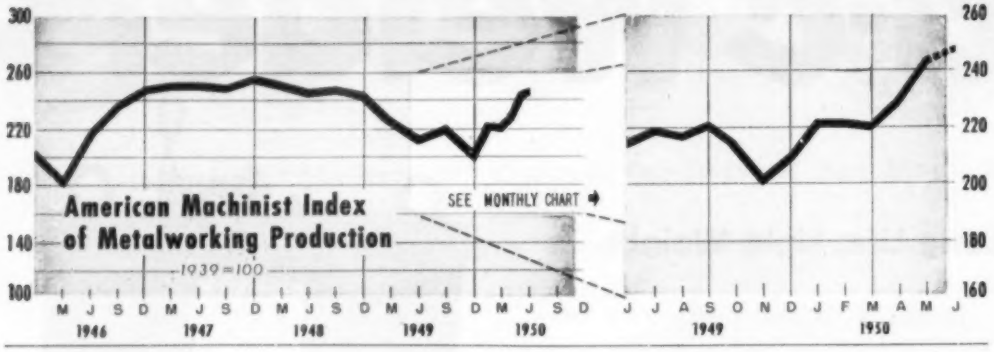
Ask your distributor for bulletin GEC-652. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

* *New, water-repellent, temperature-resisting, insulating material means increased operating dependability.*

SEE THEM AT THESE DISTRIBUTORS

MICHIGAN—Welding Sales & Engineering Co. 8750 Grinnell Ave. Detroit; Miller Welding Supply Co. 505 Fulton, Grand Rapids
MINNESOTA—Machinery & Welder Corp. 2440 2nd St. Minneapolis, W. P. & R. S. Mars Co. 324 W. Michigan, Duluth
MISSISSIPPI—Jackson Welding & Supply Co. 145 E. South St. Jackson
MISSOURI—Machinery & Welder Corp. 700 S. Spring, St. Louis (also IOWA); Hohenschild Welders Supply Co. 512 E. 18th, Kansas City (also KAN.)
MONTANA—Montana Hardware Co., 823 S. Montana, Butte
NEBRASKA—Lincoln Welding & Supply Co. 330 S. 10th, Lincoln; Baum Iron Co. 13th & Harney, Omaha (also IOWA)
NEW JERSEY (Northern)—Welding Engineering Sales Corp. 40 Goble St., Newark
NEW MEXICO—Industrial Supply Co. 1647 N. 2nd St. Albuquerque; Bowen Welding Supply, 1320 W. 7th, Clovis; Western Oxygen, Inc. 207 W. Dunham, Hobbs; Car Parts Depot, 302 N. Main, Las Cruces
NEW YORK—Welding Engineering Sales Corp. 110 E. 42nd, New York (also CONNECTICUT)
NORTH DAKOTA—Dakota Electric Supply Co. 1017-23 Fourth Ave. N., Fargo
OHIO—Burdett Oxygen Co. 3300 Lakeside, Cleveland; Menna Welding Co. 1102 West Central, Toledo
OKLAHOMA—General Electric Welding Div. 915 E. 2nd St. Tulsa
OREGON—J. E. Haseltine Co. 115 S. W. 2nd Ave., Portland
PENNSYLVANIA—Arcway Equipment Co. 49th & Grays Ave. Philadelphia (also Southern N. J.); 5118 Penn Ave., Pittsburgh
SOUTH CAROLINA—Cameron & Barkley Co. Box 906, Charleston; Welding Gas Products Co., 407 Fall, Greenville
SOUTH DAKOTA—Hendrie & Bolthoff Co. 629 Main, Deadwood
TENNESSEE—Welding Gas Products Co. Box 749, Chattanooga; Delta Oxygen Co. 611 Court, Memphis (also ARK.)
TEXAS—M & M Welding Supply Co. 1818 Butternut, Abilene; J. Ernest Stroud Co. 501 E. Third, Amarillo; Briggs-Weaver Machinery Co. 5000 Hines Blvd. Dallas; Dallas Welding Supply Co., 430 S. Industrial Blvd., Dallas; Car Parts Depot, Inc. 712 Texas, El Paso; Welding Equipment Co. 1413 E. Lancaster, Ft. Worth; Acetylene & Oxygen Co., Harlingen; General Electric Welding Div. 5931 Clinton Drive, Houston; West Texas Oxygen Co. 2607 Ave. "H," Lubbock; Western Oxygen, Inc. 2700 W. 2nd, Odessa; Plains Welding Supply Co. 221 E. 6th, Plainview; Southwestern Welding Supply Co. 65 East Ave. San Angelo; San Antonio Machine & Supply Co. Drawer 680, San Antonio; Hughes Welding Supply Co. 2007 W. 7th, Texarkana (also ARK.)
UTAH—The Gallagher Co. 545 W. 8th South, Salt Lake City
VIRGINIA—Arcway Equipment Co., 5931 Madison, Newport News
WASHINGTON—J. E. Haseltine Co., 510 First Ave. S. Seattle
WEST VIRGINIA—Bluefield Supply Co., Bluefield; Virginian Electric Inc. 57 Michigan, Charleston; Logan Hardware & Supply Co., Logan
WISCONSIN—Machinery & Welder Corp., 3623 W. National Ave. Milwaukee
ALASKA—Northern Supply Co., Anchorage
HAWAII—W. A. Ramsey, Ltd. Box 1721, Honolulu
CANADA—Canadian General Electric Co., Toronto
OTHER FOREIGN COUNTRIES—International General Electric Co.

Gaging Metalworking



War Threat Causes Metalworking Rush

Metalworking operations are going stronger than ever. Upon an already lush demand for all kinds of metal goods has been superimposed a certain amount of "scare" buying by consumers who figure they might as well get items while they can.

• • •

Over and above the terrific output of civilian goods is a slowly growing volume of ordnance work for all branches of armed services. Chances are that war contracts will be awarded in much greater numbers the next 60 days. No publicity is being given, for security reasons, to important procurement orders currently being placed.

• • •

Civilian plus military activities add up to a rush in metalworking during July and August. Only interruption is plant shutdowns for vacations which were decided upon months ago. Pressure of work has become so great upon some companies, however, that they have asked workers to accept extra pay in lieu of vacations and stay on the job.

Automotive and construction industries continue to spark metalworking more than any other consumer lines. Detroit expects to sustain present record-shattering pace indefinitely unless war contracts interfere (see Detroit, page 83.)

• • •

Agricultural implement and tractor business has been ahead of 1949 volume since March, according to reports from leading manufacturers. Continued big sales of farm implements are ascribed to maintenance of Government's price-support program rather than to Korean news. Some companies are having trouble keeping up retail inventories with retail buying so heavy.

• • •

Television and radio are going strong, particularly former. But at least one maker reports both television and radio sets being warehoused because of seasonal slowdown.

• • •

Manufacturers of valves are increasing output to keep abreast of growing industrial orders. Some of this business, delayed because customers

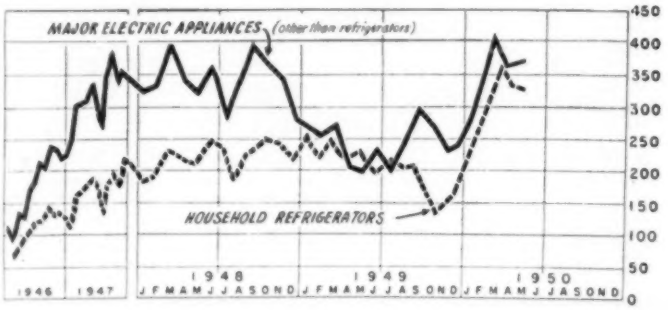
Sales of Major Electric Appliances Continue High

	MAY 1950	APR 1950	MAY 1949
Electric Household Refrigerators	328	330	220
Other Major Electric Appliances	371	359	195

(Average Month 1936 = 100)

(Major electric appliances index includes electric ranges over 2½ kw, electric storage water heaters, vacuum cleaners, electric washers, electric irons.)

Data: *Nema News*, National Electric Manufacturers Assn.



INDEX

	JUNE '50	MAY '50(p)	APR '50(r)	MAY '49
	247*	243	231	215
Machinery		227	223	211
Electrical Manufacturing		292	278	240
Automobiles, Trucks		232	205	173
Transportation Equipment		213	212	244
Other Metalworking		256	251	228

AMERICAN MACHINIST'S INDEX OF METALWORKING PRODUCTION is based on manhours worked in the five components above.

*Estimated (p) Preliminary (r) Revised

were eating up inventories, has been driven in by modest price advances. Business has been further stimulated by defense orders for reconditioning World War II equipment.

• • •

Some diesel-electric locomotive builders are booked to capacity into 1951. The spurt in freight car orders this year has resulted in step-up of production which should hold during last half.

• • •

Electric appliance people are beginning to feel a buying rush as consumers decide to purchase items while they still can get them. Outlook is for no letdown remainder of year.

• • •

Tightening of metalworking production puts a greater squeeze on steel than ever. Every steel user is trying to get more tonnage especially in flat-rolled items. The main problem is how mills can continue to supply users making civilian products and meet whatever military goods requirements may arise.

The point is that steel demand will stay at 100% of the industry's capacity as far ahead as one can see. Allocations, either voluntary or compulsory, appear inevitable very soon.

Stamping shops are being pinched by steel shortage. Reason: they get much of tonnage through customers' orders from mills; and growing number of customers are reluctant to allot stampers any of their own supply.

• • •

Nonferrous metals are as tight as steel, with prices subject to rise on short notice. Users are inclined to take as much material as they can get, but customers' inventories in general are slim.

• • •

Metalworking is finding skilled men harder to get. Unemployment has declined in July. And succeeding months will show a further drop. Personnel departments of certain companies already have been assigned the job of developing training programs for unskilled help, if and when needed.

• • •

Many plants of Timken Roller Bearing Co. have gone to six-day work week to take care of requests for military production as well as civilian requirements. Several midwest manufacturers are confined to single shifts by steel shortages and labor scarcity.

• • •

May orders for tools and dies were at highest peak since June, 1948, and up 13% from April. June sustained the May volume, according to preliminary reports. Many contract shops have lost skilled men to captive shops in companies having attractive welfare and pension programs for employees. This is especially true in Cleveland, Chicago, Dayton and Milwaukee.

Drop forge companies are mostly at full capacity, with average backlog of 3-4 months.

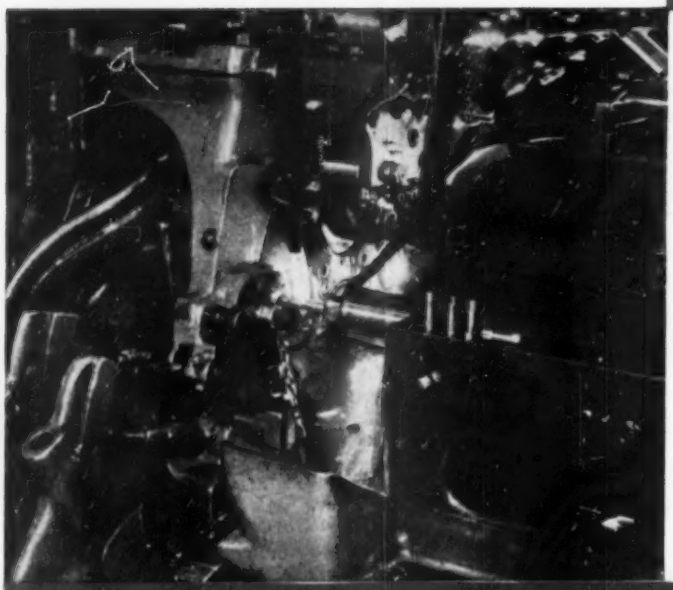
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week index of activity (1923-1925 = 100)*	216.0	217.5	178.8
Steel ingot operations (% of capacity)	96.0	92.6	77.8
Electric power output (million kilowatt-hours)	5380	6115	4982
Production of automobiles and trucks	142,548	196,767	118,611
Engineering construction awards (Eng. News-Record; millions)	$365.0	$214.4	$190.3

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators, domestic sales (thousands of units)	529	531	331
Vacuum cleaners, sales (thousands of units)	279	293	223
Washers, sales (thousands of units)	305	333	212
Household electric ranges, sales (thousands of units)	145	131	52
Television receivers, production (thousands of units)	376	420	163
Radio receivers, A.M. and A.M.-F.M., production (thousands of units)	900	883	478
Gear sales index (1935-1939 = 100)	363.1	328.6	250.1
Foundry equipment new orders index (shipments 1937-39 = 100)	294.9	160.6	121.9

*Seasonally adjusted.



PART

Over-all length	1"
Stock Diameter	5/16"
Slot	1/4" deep x 5/16"
Head	5/16" dia. x 5/16" long
Small Diameter	1/4" x 23/32" long
Milled Flats	5/32" wide on 23/32" dia.

TOOLING

Davenport 5-spindle Model B

1st position	Form and Support
2nd position	Size (shaving tool) and Support
3rd position	Mill slot (Slotting saw 965 r.p.m. 2¼", 560 s.f.p.m.
4th position	Mill flats and Support
5th position	Radius, chamfer, cut-off (Cut-off tool .0025" feed)

DATA

Material	B-1113
Cycle	3 seconds
Spindle Speed	1930 r.p.m.

875 MORE PIECES per 8-hr. shift

This TEXACO user* also reduces unit costs two other ways

When *Texaco Cleartex Cutting Oil* was placed in service as the coolant on this job, the better cooling and lubrication that resulted showed up quickly in the reduced number of necessary tool grinds.

On the slotting saw, for example, four regrinds in 24 hours were reduced to three. Cut-off tool life was extended from two to six hours. In addition to these worth-while savings in regrinding costs, reduction in down-time enabled the machine to produce an extra 875 pieces per 8-hour shift.

These two factors—increased production and reduced tool maintenance—add up to lower unit costs.

Let a Texaco Lubrication Engineer specializing in machining operations help you make savings in your plant. *Texaco Cleartex Cutting Oil* is only one of a complete line of Texaco Cutting, Grinding and Soluble Oils designed to help you do your machining better, faster, and at lower cost.

Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

*Name on request

TEXACO

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Best Preventive Against "Sneak" Attack

The Korean war makes crystal clear one conclusion. Should another war occur, it will be precipitated by a "sneak" attack.

What can we do to convince any potential enemy that such an attack would be foolhardy?

WE CAN DEMONSTRATE the ability of American industry to swing into production of war weapons the instant an emergency confronts us.

Remember the anguished cries of "too little and too late" in the early years of World War II? We started a defense program later than we should and paid a heavy price in military setbacks as a result.

But eventually America's production came to the rescue. We poured forth more weapons than the world had dreamed of.

America's superiority in production—in sheer quantity of goods turned out and in mass manufacture techniques—carried over into the postwar era. Peacetime records have fallen right and left.

BUT WITH KOREA as a grave warning, it is time to put a greater share of our industrial attention on America's defense needs.

If and when another major war should come, it won't be won by atom bombs alone, or by any other single weapon. It will be fought with a greater variety of more complicated weapons than any previous war.

It will take more machine tools and other production equipment than ever before to make those weapons. It will take better technicians and greater numbers of them. It will take the combined skill of our scientists, engineers and industrialists to insure our superiority in fighting equipment.

A start in the right direction should be made now, not when another Pearl Harbor is upon us.

The National Security Resources Board already has allocated "phantom orders" for machine tools, cutting tools and other production equipment. These orders can be activated quickly. And let's keep in mind that tooling up is the first job in any defense program.

BEYOND MOBILIZATION PLANNING, we urge that defense production be enlarged as soon as possible and that such production be spread over a large number of companies.

We should have a bigger stockpile of weapons of the latest design. Even more, we need to acquaint a wide circle of metalworking manufacturers with the know-how of making these weapons.

That means the award of educational orders on a sizable scale by the Department of Defense. Only pilot-line production will be necessary in many cases.

To be blunt, Russia knows that our industrial facilities, our mass-production techniques, and our ability to apply scientific knowledge to our defense requirements are unrivaled in the world. She knows that they have been instrumental in winning two great wars.

If we should mobilize these powerful forces immediately, they would be the best possible restraint against a sneak attack or any other act of war on her part.

Burnham Finney

contour the special job on a Cincinnati Shaper...at low cost

The special job is often a time-eater — and a cost raiser.

This handy Cincinnati Shaper saves time — saves money — on many special jobs. Little time is lost on setups — costly fixtures and special equipment are not needed.

Contouring this 1200-pound tank stave die — roughed and finished in 4 hours — is done at low cost with simple tools and simple setup. It is an example of many jobs performed on versatile Cincinnati Shapers at lowered costs.

Write for Shaper Catalog N-5, where many uses of Cincinnati Shapers are illustrated, and the wide line described.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

OUTBOARD COSTS DON'T GO OVERBOARD

Chris-Craft's new Challenger engine is a unique product because it was redesigned—after operating characteristics had been engineered into the original design—to fit in with fast, economical production in the shop. The result is a complete production sequence that machines off little more than a cupful of chips

BUT . . . **Chris-Craft had some unusual advantages over most shops before it could show this exceptional cooperation between design engineers and production executives. First, production did not have to start on any specific date, so nobody was working against a deadline; second, the design did not have to be compromised to fit existing tools and equipment because a new plant was being built in Grand Rapids especially for this model; third, the new motor did not have to follow along any existing design commandments. All it had to do was fit between the transom on a small boat and the blue water of a fish-filled lake.**

BY CHESTER S. RICKER
DETROIT EDITOR

PLAYING around with a hobby over a period of years may produce a lot of improvements in a gadget; but it also produces a frustrated designer, for few tinkerers can do anything about applying their ideas on a large scale. Jay W. Smith, however, had an advantage: he was not only tinkering with outboard motors in the summertime, but he was also chairman of the board of Chris-Craft Corporation.

He got together with Chief Engineer E. Jasper and proceeded to do something constructive about his tinkering. The goal was to work out a new motor design that would combine the improvements he had gadgeteered into his own motor with the ability to be easily manufactured. A combination of design for performance, redesign for production simplicity, material selection, and methods development made this possible.

Built-In Economies

Combining parts meant less machining to match surfaces, better alignment, and faster assembly:

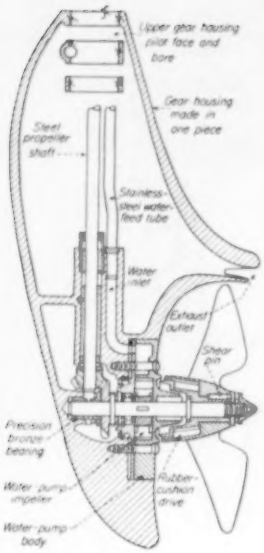
Gear case that carries the propeller, bevel drive gears, shafts, water pump, and stuffing boxes is a one-piece aluminum-alloy casting. Because it has to transfer all the power that moves the boat, the case is heat-treated for extra strength.

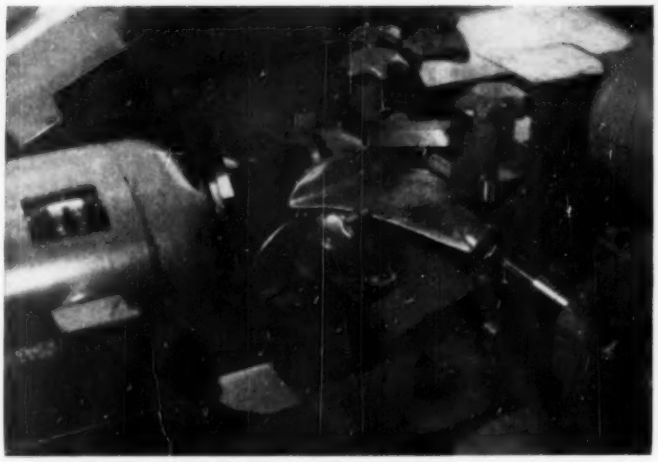
Propeller (two blades) is a permanent-mold aluminum casting on which only the shaft bore and the forward hub face have to be machined. A molded-rubber drive washer makes machining inside the hub unnecessary.

Water pump that sends coolant up through a stainless-steel tube to the cylinder block consists of a body that required only light facing and boring, an unmachined die-cast cover, a rubber seal, and a molded-neoprene pump impeller.

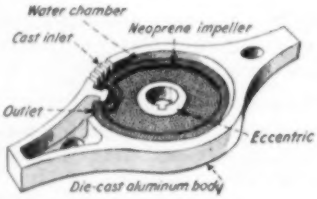
Connecting rods are aluminum die castings with bronze crank-pin and piston-pin bushings cast in place. Rod faces are milled to size and precision bored in two operations.

Cylinder liners are rough-turned





Drive-gear alignment depends on accuracy of Ex-Cell-O right-angle boring job on gear-case housing (tolerance is 0.0003 to 0.0005 in.). Gun drill piloted from bored hole in top of housing machines out heat-treated aluminum casting for lower propeller-shaft bushing



Water-pump simplicity reduces machining. Rotating steel eccentric keyed to propeller shaft oscillates neoprene impeller, which pumps water up stainless-steel tube to cylinder block

and bored before being "cast-in" with the cylinder block. The Meehanite liners are shallow-grooved and aluminum pistons are also grooved in their top lands to allow non-selective fitting.

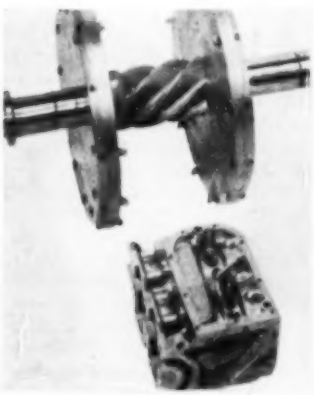
Gas tank is die-cast in two halves, then sealed with vulcanized, gasoline-resistant neoprene, and locked by self-tapping screws.

Starter clutch with three claws is one of the few steel (SAE-1020, case-hardened) parts, and is drop-forged, then machined lightly.

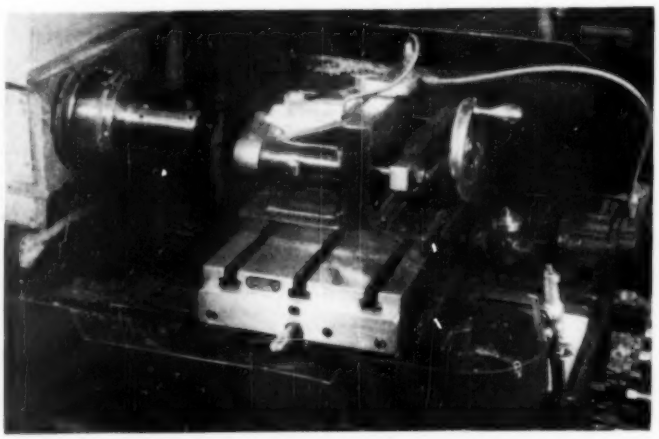
Engine Operation

The block has a detachable head and crankcase cover for quick servicing as well as simple assembly. The exhaust side of the block is opened and closed by a plate, allowing three holes to be drilled in each cylinder barrel. Alignment of the engine and gear-case units is held by a brass tube inserted in an extension of the bottom plate.

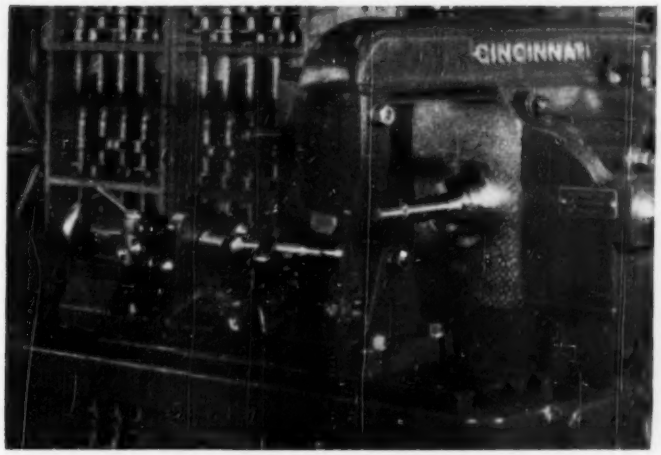
Reed intake valves are carried on the intake-manifold casting that also supports the carburetor and



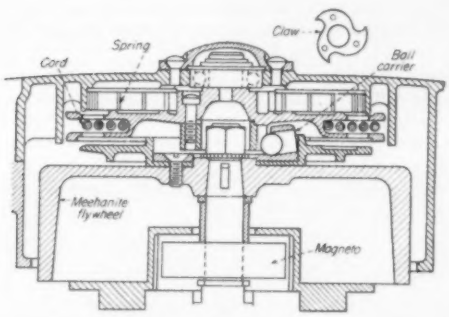
Cylinder casting is finished by ganged carbide-tipped cutters and helical milling cutter. Small block size allows cutter combination that leaves fine finish at fast production rate



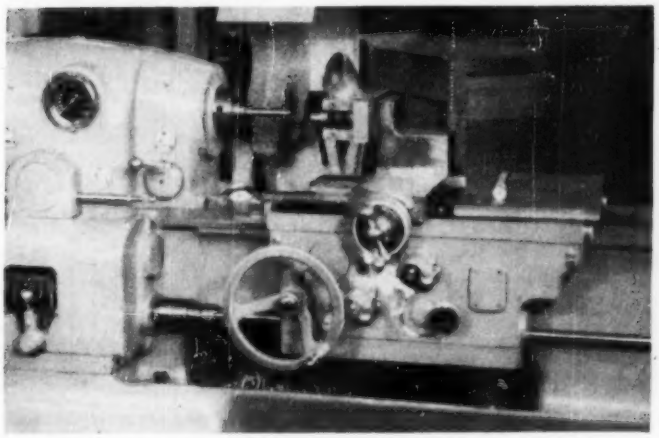
Cylinder sleeves, cast of Meehanite in the aluminum block, are finish-bored at 400 sfm. Center distance between the two cylinders is only 2 5/16 in., so sleeves are machined automatically in sequence



Counterbalanced crankshaft is an SAE-8620 forging. Six splines are milled on shaft end in Cincinnati 0-8 with index plate. Other shaft operations are turning on Gisholt lathe and crankpins and main bearing journals on Cincinnati and Landis machines



Centrifugal starter works when three stainless-steel balls key starter claw-clutch suspended from cover to forged-aluminum ball carrier on top of flywheel. Die-cast plate around ball carrier confines them when centrifugal motion of powered crankshaft throws them out of engagement

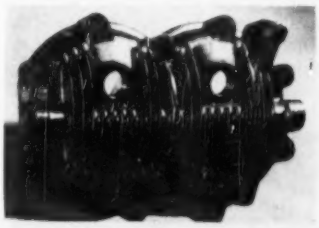


Propeller bore is finished in half a minute by carbide tools cutting at 950 sfm on a Monarch lathe. Light grinding on leading fin edges is only other operation on the part

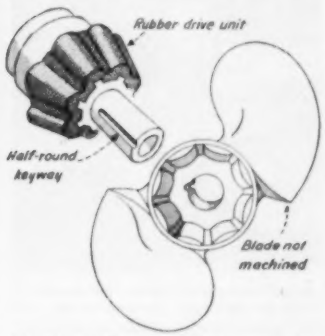
slips into a chamber in the crankcase cover. The manifold is smooth-faced in the inner end and flanged on the outer end. Between the flange on the manifold and the outside wall of the case an O-ring seals off the metal-to-metal joint, yet allows for expansion when the inner end of the manifold is drawn down gas tight.

The engine is a fast-selling size —5.5 hp at 4000 rpm—and only weighs 46 lb. For idling and trolling, the propeller can be throttled down as low as 400 rpm. Easy starting is assured, partly because of the ball-and-claw clutch, and partly because of a device that cuts flooding. Small drilled passages through the crankcase to the carburetor clear out excess fuel.

Precision bronze bushings are installed throughout the motor, and most parts are Alodine-treated aluminum, to resist corrosion. The propeller shaft is K monel. Driven-shaft and crankshaft are connected by a hardened-steel splined sleeve that virtually broaches itself onto the shaft when assembled.



Die-cast detachable head of aluminum has no water jacket. Fins help air-cool heads; cast water passage close to plugs keeps them cool



Aluminum-alloy propeller, made in permanent mold, is shock-mounted by rubber coupling. Shear-pin key is round; can be a nail in emergency

PAPER TEMPLETS CONTROL DRILLPRESS

BY PAUL BONNESS, Manufacturing Engineer
INDUSTRIAL CONTROLLER DIV., SQUARE D CO.

PANEL BOARDS for electric control cabinets are drilled to suit specified combinations of relays, switches and other control apparatus, and are usually produced in small lots to suit customer requirements. They are made from insulating board, laminated phenolic plastic, wood or slate.

Holes range up to ⅞ in. in dia, and carbide-tipped twist drills are used. Panels made at the Milwaukee plant of Square D Co. are from ½ to 1½ in. thick, and as large as 24x48 in.

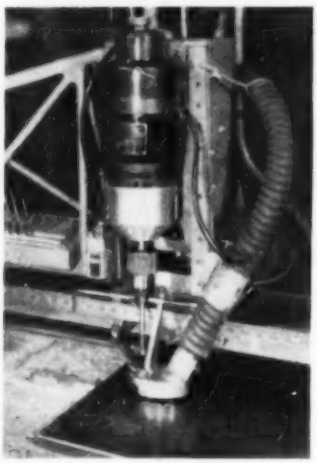
Until recently, panels made frequently were drilled in standard drillpresses, using plate jigs with fixed guide bushings to locate the various holes. Those made in small quantities were scribed to locate hole centers and drilled without jigs. Jigs cost from $25 to $75, were easily damaged, even when stored in racks with separating panels, and were difficult to revise when even minor changes in hole locations were necessary.

A shop-constructed drilling machine controlled with punched paper templets has eliminated the need for jigs or layout. It consists of a large wood-faced table on which the panel is mounted, and a steel-faced templet table nearby. Drillhead is made from 1/3-hp, vertical, Lee adjustable-speed motor with a ball-bearing spindle head mounted on the lower bracket. The motor and an air feed cylinder are mounted on a wheeled carriage on rails supported by a traveling bridge which moves along rails bolted on each side of the panel support table.

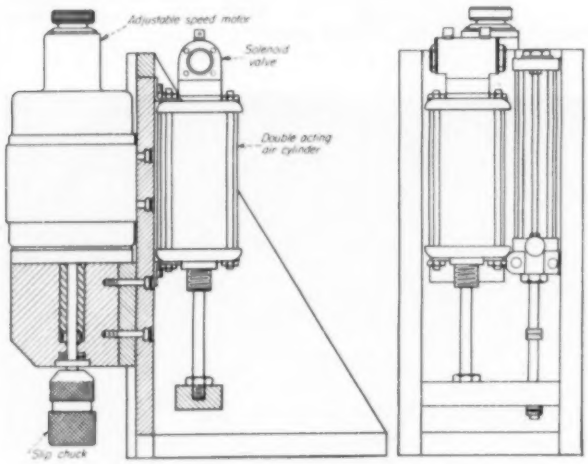
Extending from the left-hand side of the drill column is a 4-ft welded aluminum, stylus-support frame that extends over the steel-faced templet table. The operator sits between the tables and moves the stylus by hand until it enters a ⅛-in. hole punched in the paper templet, thus locating the drill above the hole center of the panel board. The silver point on the stylus makes contact with the face of the templet table to close an electric circuit and operate solenoid clamps to lock the drill carriage and bridge.

When clamping is complete, an indicator light is illuminated in front of the operator. He then pushes a button to open a solenoid air valve and move the drillhead down against the work. Depth of drilling is controlled by a limit switch on the carriage, actuated by a pin in the motor frame. Plunger of this switch is drilled and tapped to hold threaded pins of different lengths, to permit quick change of drill depth setting.

A bracket on the drill column supports a guide bushing close to the surface of the work. A hood surrounds this bracket and is connected to a flexible hose leading to a dust collector to keep chips cleared away.

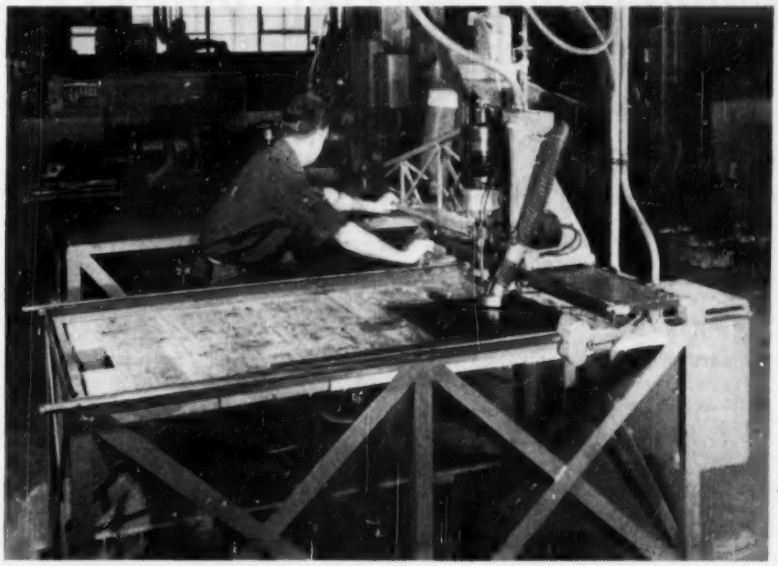


Adjustable-speed motor has range of 1000 to 6000 rpm, controlled by dial on upper bracket. Housing on lower bracket supports spindle carrying quick-acting drill chuck. Shown also is bracket holding guide bushing close to surface of panel being drilled

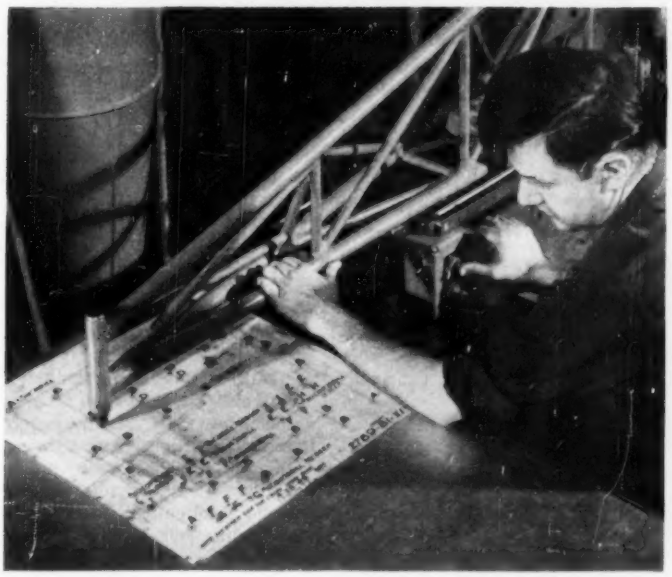


Drill motor is mounted on slide held between rails of drill column. Behind slide is 4-in. Bellows solenoid-controlled, double-acting air cylinder and Hydro-chek feed-control unit. Both units are bolted to slide, and piston rods are connected to cross-bar welded to drill column

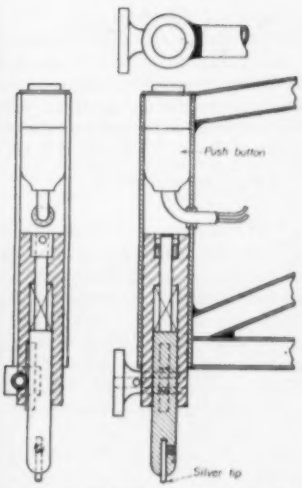
Dispensing with jigs, an ingenious, shop-made drillpress drills mounting holes in electrical panels by remote control from a paper templet



Panel drilling machine paid for itself in six months of use. Toggle clamps hold panel in correct relation with paper templet on second table so operator need only locate stylus in hole in templet and then move pushbutton to start drilling cycle. Wooden planks of drill table can be replaced when weakened by holes drilled into face



Paper templet is mounted on steel-topped templet table with Scotch tape. Steel surface is wire brushed to insure electric contact when stylus enters ¼-in. hole punched in templet at drill location. When holes are to be counterbored from rear, templet and panel are turned over and templet holes again used to locate the drillhead for counterboring



Stylus is mounted in spring-loaded holder. The 0.125-in.-dia silver tip of stylus extends 3/16 in. from holder. Point of stylus has 1½-in. radius so it can be moved out of hole in templet without tearing paper. Pushbutton in upper end of stylus tube controls drill-feed solenoid valve when operator must stand a considerable distance from normal pushbutton station

SELECTION OF PRODUCTION MILLING PROCESSES..II

BY MARIO MARTELLOTTI, THE CINCINNATI MILLING MACHINE CO.

Abreast milling permits effective time savings in handling and idle cycle time and in milling time. Multiple milling on long pieces is done on either standard or special machines.

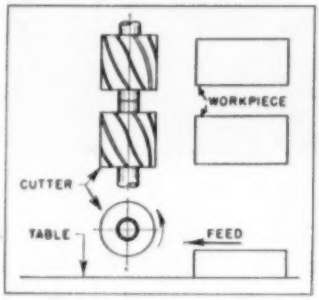


Fig. 1 .. Abreast milling is an excellent method of processing identical parts, or for a set of different parts in which the length of cut is similar in nature and dimensions

SAVINGS in cycle time can be obtained in some milling applications by using the machining method known as abreast milling. With this method, Fig. 1, two or more pieces are placed in a row aligned at right angles to the direction of table feed. Thus, the pieces are milled simultaneously rather than consecutively.

Abreast milling offers the advantage of performing either the same or different milling operations on the various pieces. Table travel is the same as that required when milling a single piece, but time per piece is only a fraction of that required to mill one pece.

Abstracted from "A Treatise on Milling and Milling Machines," which will be published at an early date.

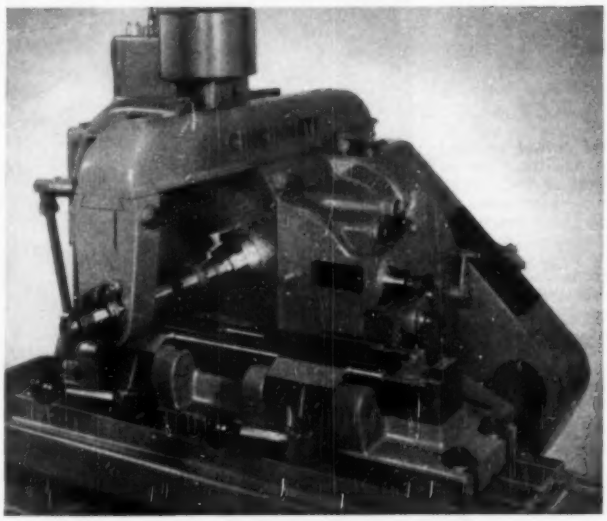


Fig. 2 .. Two keyways in each of two shafts are abreast milled simultaneously, using a rise-and-fall manufacturing milling machine

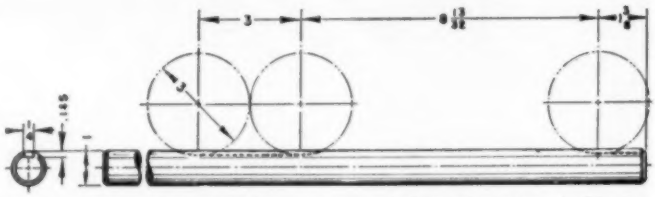


Fig. 3 .. Different lengths of keyways are milled in setup shown in Fig. 2.

Cycle time per piece is expressed as: $t_c = \frac{1}{n_a}(t_m + t_l + t_h)$

where:

- t_c = cycle time per piece, min.
- n_a = number of pieces abreast
- t_m = milling time for n_a pieces, min.
- t_h = handling time for n_a pieces, min.
- t_l = idle cycle time for n_a pieces, min.

Abreast milling is particularly advantageous in reducing milling time when length of cut in parts to be milled is relatively great, and milling time is a substantial part of cycle time. More cutters are needed, however, simultaneously to mill a number of pieces than in string milling. To insure close dimensional accuracy, cutter spacing and positioning of the workpiece require more than ordinary attention.

Milling Keyways Two Abreast

Abreast milling in combination with rise and fall of the spindle

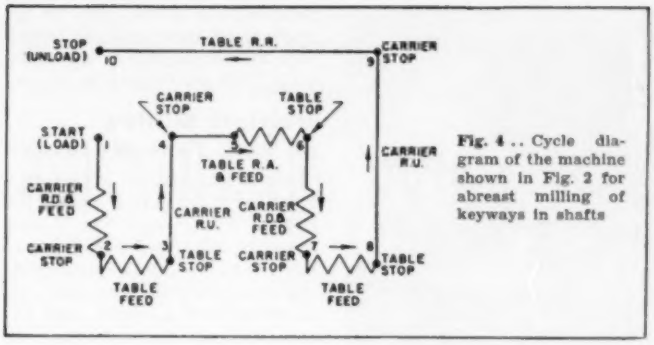


Fig. 4 .. Cycle diagram of the machine shown in Fig. 2 for abreast milling of keyways in shafts

carrier is conveniently used in milling keyways. In the example shown in Fig. 2, keyways are milled simultaneously on two long steel shafts, Fig. 3.

The two shafts are placed side by side in V-blocks and against end stops, and are clamped by means of two hand clamps. The cut is taken by up milling, feeding the workpieces to the right. Cycle of operation, shown diagrammatically in Fig. 4, is controlled by a 10-station cam cycle selector.

In the loading position, forward ends of the two shafts are placed so cutter approach is 1/4 in. Without the rise-and-fall movement of the spindle carrier, the approach would be 11/16 in. Close positioning of the workpiece relative to the cutter is made possible by the fact that the spindle carrier is in raised position, thus providing sufficient room for the operator to load and unload the fixtures.

When loading has been completed, the spindle carrier is lowered rapidly at a rate of 80 ipm for a distance of 2¼ in. Then rate is reduced to 10 ipm for an additional vertical distance of 1/4 in., as the cutters approach the workpieces and begin to mill to the full depth of the keyway. When full depth is reached, the spindle carrier stops. See Stations 1 and 2, Fig. 4.

The table now begins its forward movement to the right at a rate of 10 ipm, stopping when it has traveled a distance of 1-5/8 in. This is equal to the 1/4 in. approach, plus the 1⅜ in. length of cut of the first keyway, Station 3.

The spindle carrier is now raised rapidly at 80 ipm and the milling machine table is rapid-advanced to the right at 400 ipm for a distance of 8 5/32 in.; then it is slowed down to the feed rate of 10 ipm for a distance of 1/4 in. and stops. Thus, the table has traveled a total distance of 8 13/32 in. to position the shafts for milling the second keyway, Stations 4, 5, and 6.

As the table stops, the spindle carrier is lowered at 80 ipm, and then slows down to a 10 ipm feed rate, until full depth of the keyway has been reached, at which time the spindle carrier stops.

The table now resumes the feeding rate (Station 7) for a distance of 3 in. to mill the second keyway, then stops. After this, the spindle carrier is raised rapidly upward (Station 8) and the table is rapid-traversed to the left (Station 9) to return it to stop position (Station 10). The last position is the same as the starting position of the cycle. The two shafts are then removed from the fixture, two new shafts are put in their place, and the cycle of operation is repeated.

For this operation, time study shows total time of 1.006 min., and cycle time is 0.503 min. per pc.

Production rate is 101 pcs per 51 min. hour, or approximately twice that which would be obtained under the same conditions when milling only one piece for each machine cycle. More loading time is required for two pieces than one piece. However, by employing simultaneous clamping of both

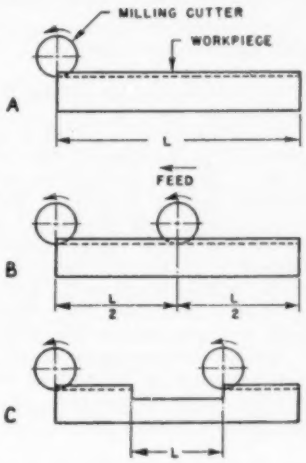


Fig. 5 .. Long or interrupted surfaces such as *B* and *C* are milled in half the time required at *A* by applying the multiple milling method

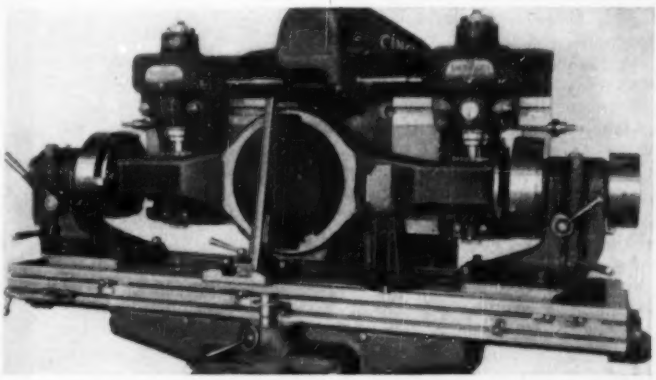


Fig. 6 .. Spring pads on a rear-axle housing are multiple milled by two special vertical heads applied to a plain knee-type milling machine

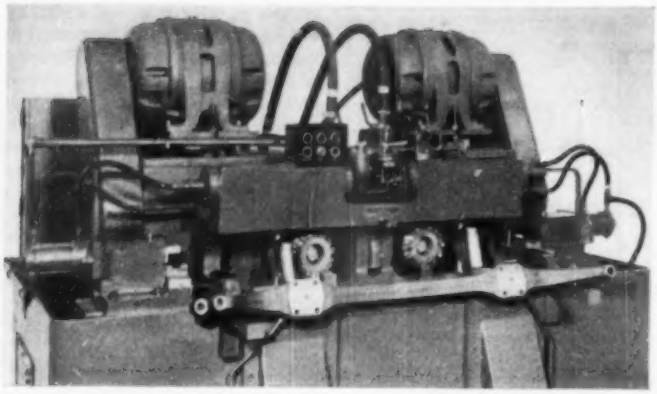


Fig. 7 .. Special milling machines are built for multiple-milling operations. This special two-ram machine mills the spring pads on front axles

pieces, the loading time is usually less than that required for a single piece.

Multiple Milling on Long Pieces

In some applications, a result similar to abreast milling can be obtained by using several cutters, located at a selected distance from each other in relation to the length to be cut, so milling takes place simultaneously at different points over this length. This principle is diagrammatically shown in Fig. 5.

View *A* shows a milling cutter milling a piece of length *L*. View *B* shows two cutters milling the same piece, but set apart a distance equal to *L*/2, so each cutter will simultaneously mill half the length *L*. It is apparent that, assuming the same feed as in case *A*, milling will be completed in half the time.

A variation of this method is shown in view C. Here, two cutters are milling two pads, located at a distance *L* apart, in the time required to mill one pad. Fig. 6 illustrates an application of this principle in milling the spring pads on a rear-axle housing.

The setup is made on a plain knee-and-column type milling machine with two special vertical milling heads which can be adjusted laterally. The head at right also has a quill adjustment of the spindle to enable the operator to set the two sets of straddle mills, mounted one on each spindle, at correct height from the surface of the machine table.

The axle housing is placed in a trunnion-type indexing fixture. It is set in position for milling by squaring up the surface of the banjo opening with the table by means of a special square shown clamped to the machine table. Opposite surfaces of the spring pads are milled simultaneously by first using the cross-feed of the table to the permissible depth of cut, then engaging the table feed to mill the length of the pads. The axle is then indexed 180° to complete milling of the pads by repeating the same cycle of operation. Production rate is approximately 7 pcs per 51-min. hr.

Multiple Milling on Ram-Type Machine

Another application of this principle involves milling the spring pads of a front axle, Fig. 7, with a special ram-type machine with two heads. The single-piece holding fixture is built into the main frame of the machine, and incorporates pneumatic clamps.

The rams move in opposite directions at the feed and rapid traverse rates required by the machine cycle. This is done to neutralize the cutting loads of the two 6-in.-dia HSS shell end mills, one mounted on each spindle.

Operation cycle is: Feed rams to mill, stop the feed and cutter rotation, remove axle before returning rams to the starting position (to prevent the cutter teeth from damaging the milled surface), rapid return rams to the starting position, reload fixture, and re-start spindle rotation and cycle.

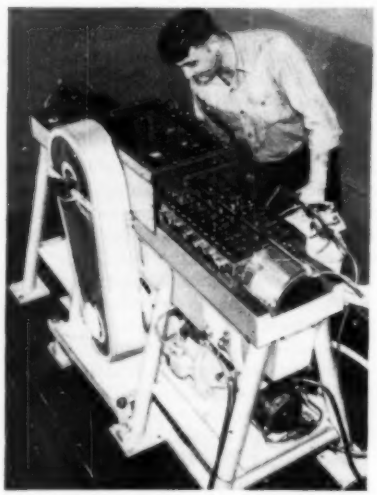
Production rate is approximately 49 pcs per 51-min. hr.

A further instalment on production milling processes will be published in the August 7 number.

Chrome Plate vs Engine Performance

CHROME-PLATE QUALITY, rather than variations in engine performance, is the deciding factor in cylinder-liner wear. Tests on 3,861 types of chromium plate on liners for both diesel and gas engines have proved that to the U. S. Naval Engineering Experimental Station at Annapolis.

"Accelerated wear test" machine at the Internal Combustion Engine Laboratory checks wear at the top of each cylinder stroke, where wear is most noticeable. Wear as little as 0.00005 in. can be detected.



Cylinder liners undergoing rapid-wear cycles can be observed through the glass top

Schedule, plans, progress—none are secret in this little shop . . .

Teamwork, not bossing, gets Bill results the big shops can't

Bill Tells the Girls

BY JOHN R. GODFREY

BILL had been kicked around more or less before he started his own little shop. No one ever accused him of being lazy or of not knowing his business. In fact he was a sort of trouble shooter, and his experience and horse sense had saved his old boss a lot of dollars on several occasions, when the engineers seemed to be stuck.

But the boss had a hankering for college men, and the fact that Bill pulled the letter men out of expensive holes wasn't enough for the boss to boost Bill into the higher brackets on the pay roll. So Bill took the plunge (so often fatal to really good mechanics) and went out on his own.

I understand that his old boss is plenty sore because Bill is getting contracts that used to go to the big shop, and at a better price, just because of more prompt deliveries. The old boss cannot see why this is so. He has called conferences and had his planners on the carpet, but Bill still gets the business.

So I dropped in to see Bill the other day. When the time was right, I asked him how he planned his delivery schedules. Told him I'd heard he had some new scheme and that it worked.

Bill laughed. "Guess it is new, Godfrey, at least in this business. It wouldn't work in the old shop, or in any large shop, I guess." No, he didn't have a planner or a production manager. That was his job. But even he could forget it as soon as he'd made a sort of a master schedule. "Fact is," he said, "I had no idea I was starting anything new. It sort of grew out of thin air.

"Some time ago, I had a pretty heavy month scheduled on some small parts. They were partly punch press, partly bench lathe. So I made out a sort of master schedule to show how many of each part were needed every day to keep our customers happy.

"I talked to the five girls who handle this work and outlined the schedule from time to time, and the work started to come through like clockwork. It still does. After they get a copy of the schedule, I can almost forget that I'm running the shop."

No Forelady

I ventured the opinion that he must have an unusual forelady to keep the rest of the girls on their toes. He sort of grinned.

"The fact is," he said, "there isn't any forelady—at least no one has the title. The one who seems to steer the crew is the youngest of the lot. She doesn't do any bossing at all. They seem to be more cooperative as a group than any I've ever seen.

"They get a good hourly rate, above the average. They all get the same. They consult the schedule and divide up the work as they think best. They switch off from punch press to bench lathe. Just who decides when to shift, or why, I haven't any idea. I don't care as long as they get out the work and stay happy. That's the main thing.

"Once when I was pushed for time on a big job they offered to come in on Saturday—we only work five days, you know—and work for nothing to meet the schedule. Of course I paid them time-and-a-half and was glad to.

"Once we ran short of stock for nearly two days. I told them to stay home or go on a picnic, and I guess it surprised them to get full pay in their envelopes—or so they said. But they made up for the lost time by boosting production so we met our delivery dates. They are a swell bunch of gals."

Understudy, Too

Bill also had a sort of understudy who seems a rather unusual find. After advertising, unsuccessfully, for the kind of young man he wanted, the chap in question blew in one morning, cold turkey. After a friendly chat, Bill hired him on the spot. The boy had some shop experience and caught on quickly. Bill asked him what he thought he ought to get and paid him his price without any argument. He did so well Bill boosted him twice in the next six months. Talking matters over with the lad one day, Bill asked him what he thought he ought to be worth the next year. The lad was sort of dumbfounded. Who wouldn't be?

No Answer

Instead of taking a chance with a snap answer, the lad said he'd have to think it over. He had some ideas of his own and he wanted to study the situation. The last I knew he hadn't told Bill what he thought he ought to be worth. Did you ever have a boss who would think of asking such a question? In all my jobs I had to do the asking, and the "getting" wasn't easy.

As I said, you couldn't run a big shop as Bill runs his. But Bill is making a lot more per dollar of investment than his old boss.

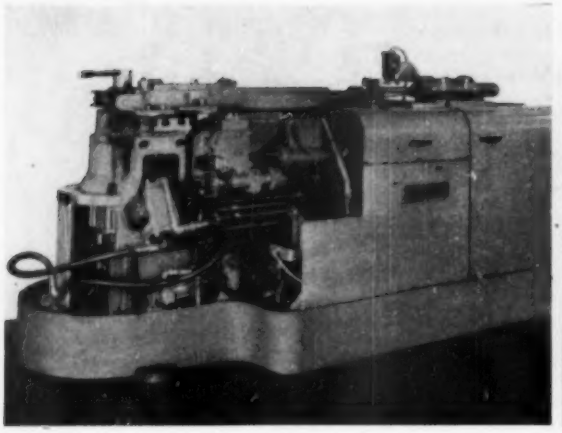


Fig. 1—Powerful, automatic machines form tubing parts by revolving-die principle. In this case, the machine is fitted with a sliding wiper die actuated hydraulically

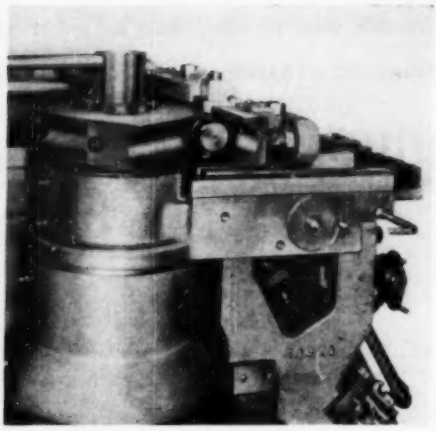


Fig. 2—Tubing is inserted in the bending dies and over a stationary mandrel. This is pulled back to remove the finished part

PRODUCTION TOOLS BEND TUBING

BY H. M. WILLIAMS

FOUR production methods are now in use for making the great variety of bent-tubing parts consumed by various industries.

For lower-quantity production and involved forms, presses and bulldozers are used in many ways. The common male-female die is particularly well adapted to bending of large radii and irregular curves. Heavy pipe and tubing is bent on horizontal presses. Very complex bent shapes are produced in rocking dies fitted to mechanical or hydraulic presses.

High-quantity production needs for simple parts are handled with automatic bending machines. These operate on these principles:

1. A revolving die form with stationary ironing die and mandrel.

2. The floating wiping die for bends of changing radius.

3. The push-the-tube principle, which is used to hot form large and heavy wall tubing.

Thin-wall tubing is usually handled with the revolving die form. The tubing is placed on a suitable mandrel and clamped. Then the clamp and revolving die pull the tube around the bending die and over the mandrel. For short bends in thin-wall tubing, an inner shoe is required to prevent wrinkles, and the mandrel prevents collapsing of the tube.

Tools in great variety are required to accomplish the various kinds of bends possible by use of the above principle. Tube bending dies are shown in Fig. 6. Details are:

The standard revolving die *A* has a hardened steel clamp section *B* bolted to it. The advantage of the bolted-on clamp is this: it can be installed on bending dies of several radii for bending the same tube OD regardless of the wall thickness. Cost is thereby reduced.

Bending die *C* is the solid type and is used where the bending radius is too small for use of the bolted-on clamp.

Clamps *D* are used on the revolving die *A* for making a bend immediately at the end of the radius of a previous bend, the second bend being of whatever degree is required.

To do this class of bending on thin-wall tubing, it is necessary to use arbor *F*, which has a ball support inside the main arbor and will enter the first bend, regardless of its position, in order to prevent tube collapse.

For heavy-wall tubing, a solid mandrel like that at *G* is required. It is set slightly ahead to push the outside wall out and hold the tube round in the bend. Springback is reduced by stretching the outside wall.

In bending thin-wall tubing to a short radius, as shown at *A* and *B*, Fig. 5, a 4-ball mandrel, as at *H*, Fig. 6, is required. And to prevent wrinkles on this class of work, an inner shoe *J* is needed. This shoe must have a razor edge at the centerline of the bending die and be a perfect fit on the inside of the bend. When the shoe is properly installed on the inside of the bending die, and the wiping die is properly adjusted, a commercially perfect bend can be secured in properly annealed brass.

Item *K* is a sliding wiper die.

With the proper tooling, tubing can be bent to short radii, and strips and channels can be bent edgewise. For economy in operation, parts like *A* and *B*, Fig. 5,

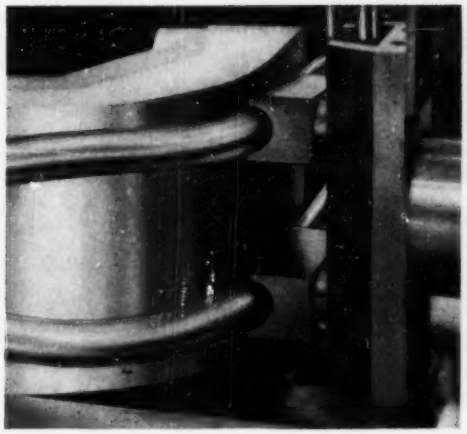


Fig. 3—A floating wiper die is attached to a stationary arm and wipes the tubing into grooves of changing radius in the stationary dies

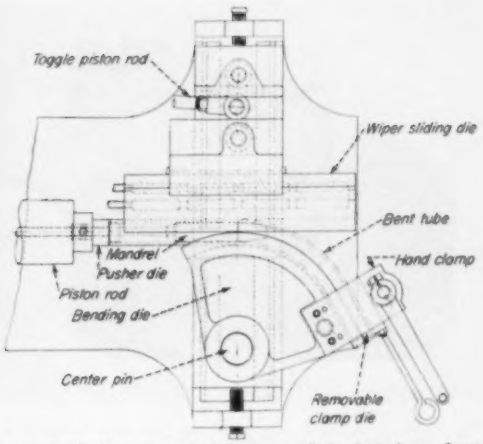


Fig. 4—Push-the-tube principle is used to hot form large, heavy-wall tubing. Revolving die and work are heated, sliding die is water-cooled. Thus, tube outer wall is not thinned

QUICKLY

are bent in two lengths and then cut in half and the ends of the bends are trimmed.

Parts C are airplane-intake pipes of thin-wall steel tubing bent in similar tools.

To bend a channel *D* and a square tube *F*, modifications in tooling are required. The channel shown was approximately 2 in. wide. One flange was approximately 1/4 in. high, the other about 1/2 in. Inside radius of the bends in the 1/32-in. thick material was about 2½ in. A set of dies generally similar to those in Fig. 9

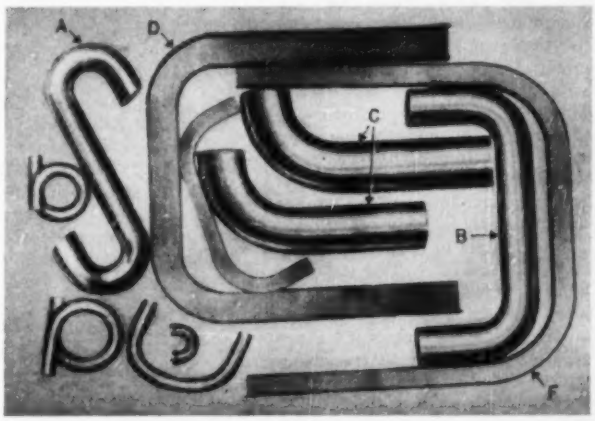


Fig. 5—Round tubing is bent with revolving dies; square tubing, strips and channels are formed with split dies, so that parts can be removed, despite some upsetting. Plumbing fixtures are bent in two lengths and cut apart

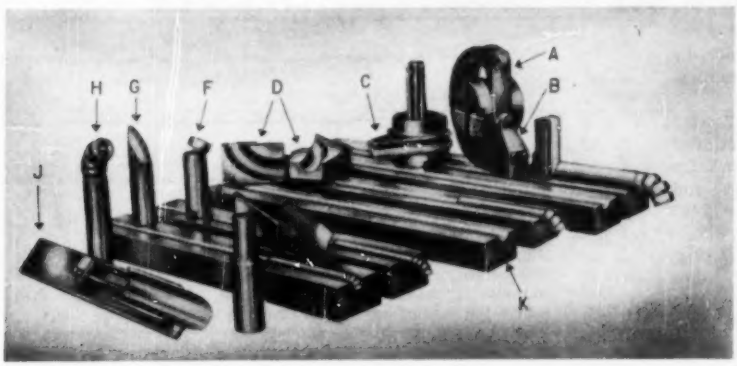


Fig. 6—Quality of the bend depends upon correct combination of tools. To prevent collapse of thin-wall tubing, a ball-type mandrel is substituted for a solid mandrel, and an inner shoe may be used

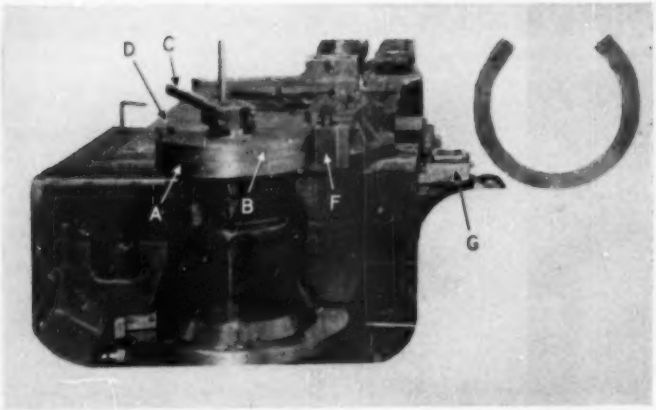


Fig. 7—To bend strip edgewise, the machine is fitted with split dies. After inserting the strip between the dies, the upper member is depressed by a clamp. Two operations produce 320° bend in part

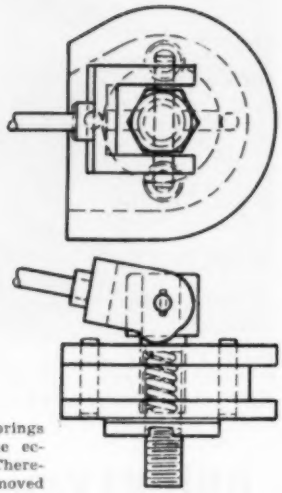


Fig. 8—Pressure of pocketed springs opens the split dies when the eccentric clamp is released. Thereupon, the part can be removed

were applied to the machine illustrated in Fig. 7.

In bending square tubing, and also for edgewise bending of channels and strip, split dies are customarily used. The upset on the inside of the bend swells the material, and it cannot be removed without separating the tools. Therefore, at the start of the cycle, the dies are opened, the work inserted and clamped, the work bent, the clamp released, the die is opened by confined springs, so that the piece can be removed.

An example of such work is illustrated in Fig. 7. The job is to bend edgewise a strip of 16-ga steel 1½ in. wide to 320°. Revolving die *A* and upper die *B* are separated by releasing the clamp *C*. The strip is inserted and held by two sharp-pointed setscrews *D*. Sliding wiper die *F* advances as the strip is bent 180°, and then returns to its starting position automatically, when the wiper-die support *G* is retracted by the cross-slide *G*.

Since the part requires a 320° bend, the piece is now taken out of the machine and turned end for end. It is reinserted to a gage and the bend is completed by 140° rotation of the die.

If a channel like that at *D*, Fig. 6, is to be bent edgewise, split dies and a flexible mandrel, as shown in Fig. 9, are required. This mandrel is made so that it can be used

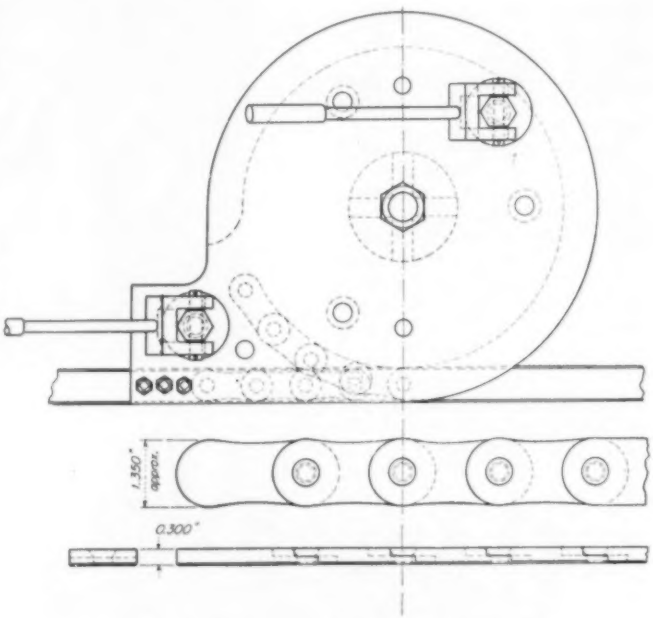


Fig. 9—To bend thin channel edgewise in revolving split dies, a flexible mandrel is required to prevent wrinkles in the part. The mandrel must be a tight fit between the legs of the channel and bear against the web also. Sharp-pointed setscrews in the upper die are to prevent the stock from slipping during the bending operation

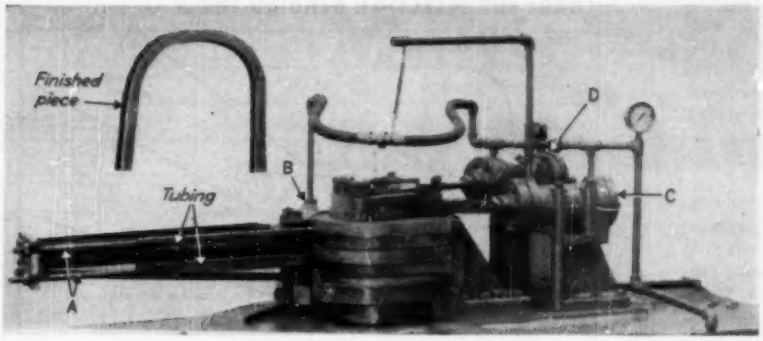


Fig. 10—Square tubing can be wrapped around stationary dies of the split, spring-loaded type. A bending arm is operated hydraulically. Production amounted to 90 pcs per hr

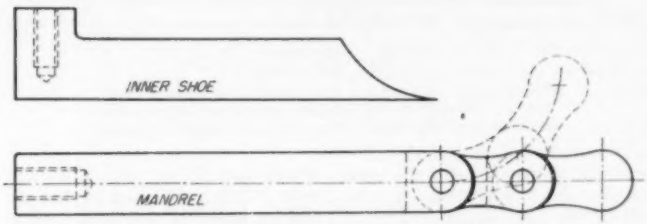


Fig. 11—To bend square tubing and channels, a flexible mandrel is required. Links have a concave radius suited to the radius of curvature of the bend. Inner shoes for the bending dies prevent wrinkles

either side up. It is very important that the thickness of the mandrel be sufficient to fit closely between the legs of the channel and against the web, so that no wrinkling can occur on the inside during the bending operation.

Sometimes square tubing is wrapped around stationary dies by a bending arm. This type of setup, Fig. 10, is used to make a support for an automobile spare-tire carrier from 1¼ in. sq 16-ga mild-steel tubing. Two tubes are set in the dies, which are spring-loaded and partially open at this part of the cycle. Arbors *A* are inserted in the free ends of the tubes; short square plugs are inserted in the opposite ends to prevent collapse from clamping pressure.

To start the cycle, the operator opens a valve that supplies oil under pressure to cylinder *B*, which forces the tubes into the die openings. Cylinder *C* closes the dies by wedge action to prevent upsetting and wrinkling. An eccentric clamp operated by cylinder *D* holds the tubing so that it cannot slip during bending. Opening a valve, not shown, causes the bending arm and wiper die to swing about the stationary dies, forcing the tubing into the openings and constraining it to bend to the desired radius.

The product actually incorporates three radii: two short radii at the corners and a longer radius at the top center. The mandrel used was of the hinged type similar to that shown in Fig. 9.

Selection of the type of production bending equipment depends upon the mechanical and physical properties of the tubing. In general, tubing should have a high elongation, a low ratio of yield strength to tensile strength, and a sufficient high ratio of wall thickness to tube OD. Ductility is required to permit

MINIMUM RADII FOR BENDS OF 45° OR MORE IN TUBING

Annealed Seamless or Welded Steel Tubing and Brass Tubing

Tube Dia.* In.	Wall Thickness In.	Without Mandrel	With Mandrel	With Mandrel and Shoe	Nickel Steel Annealed at Bend	Brass Annealed at Bend
⅛ to 1	0.065	6 D	1¼ D	1 D	1¼ D	1⅛ D
⅛ to 1	0.049	7 D	1¾ D	1¼ D	1½ D	1¼ D
⅛ to 1	0.035	8 D	2 D	1½ D	1¾ D	1⅜ D
1¼ to 2½	0.083	6 D	1½ D	1¼ D	1½ D	1¼ D
1¼ to 2½	0.065	7 D	2 D	1½ D	2 D	+
1¼ to 2½	0.049	7½ D	2½ D	1¾ D	2¼ D	+
1¼ to 2½	0.035	7½ D	2¾ D	1¾ to 2 D	2½ D	+
2¾ to 4	0.083	8 D	3 to 4 D	2 to 3 D	3 to 4 D	+
2¾ to 4	0.065	8 D	3 to 4 D	1¾ to 2½ D	3½ to 4 D	+
2¾ to 4	0.049	9 D	3½ to 4½ D	2½ to 3 D	4 to 4½ D	+
4¼ to 5	0.083	8½ D	4 D	2 D	3½ to 4 D	+
4¼ to 5	0.065	9 D	4¼ D	2½ D	4 to 4½ D	+

* Dia = OD.
\+ Varies with tube dia., wall thickness and annealing at bends.

stretching the outer wall without rupture. But the material must also have enough stiffness to prevent buckling or failure by compression at the inside of the bend. And the stock should have sufficient strength to withstand the combined effects of tensile and flattening stresses.

For a severe bend, it may be desired to determine the amount of thinning that will take place in the outer wall. The following empirical formula has been found nearly accurate:

$$t_2 = \frac{t_1 \times 2R + D}{2\ (R+D)}$$

where

t_1 = original wall thickness
t_2 = final wall thickness
R = centerline radius of the bend
D = tube diameter

To determine when a shoe or mandrel or both must be used, refer to the chart in Fig. 12.

Free ends of tubes will not be square and will require trimming, when the bends are placed close to the ends. Such conditions, Fig. 13, cannot be prevented because of metal flow on inside of bend.

The amount that must be trimmed varies according to the distance of the center of the bend to the end of the tubing before bending. To obtain a straight, or square end, this distance must be 4 to 6 times the tube diameter. Also, the thinner the tubing, the greater this distance must be.

Tube reducing down to approximately 10% is quite simple and can be done on almost any type of press or forging machine. However, when extreme reductions are necessary, such as reducing tubes to be used as drive shafts on automobiles, trucks, etc., it is necessary to have precision ground and polished dies and above all, proper lubrication. The largest reduction recommended in one pass is approximately 28% of the tube dia. However, a 36% reduction can be obtained in two passes.

When a reduction stroke is started it must proceed to the finish. If the die is stopped and the metal stops flowing and the die is started again, the tube upsets between the clamp die and reducing die. A general view of clamp and reducing dies is shown in Fig. 14.

Sizing bent tubes, and eliminating wrinkles on the inside, is usually done with balls on a long-stroke horizontal press, especially where long bent tubes are to be sized. A horizontal magazine holder is installed on the bed, permitting installation of various magazines to hold the proper sizes of balls. A plunger of the correct size is attached to the ram. The bent tube is clamped in dies having the correct diameter and curvature to fit the O.D. Balls slightly smaller than the final size are pushed through, followed by one or two finishing balls.

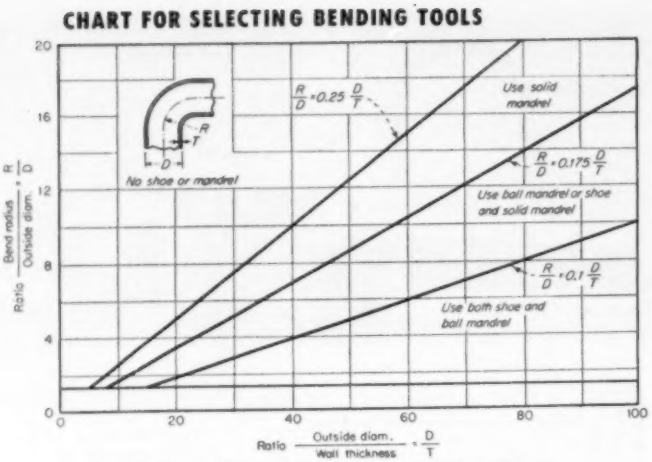


Fig. 12—Type of mandrel and need for a shoe depend upon the severity of the bending operation. Decreasing the radius vitally affects the type of tooling required

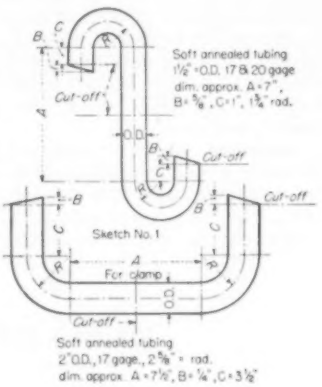


Fig. 13—Square ends will not be produced on bent parts if the bends are located from 4 to 6 dia from the free ends. Hence, a trimming allowance must be applied in such cases

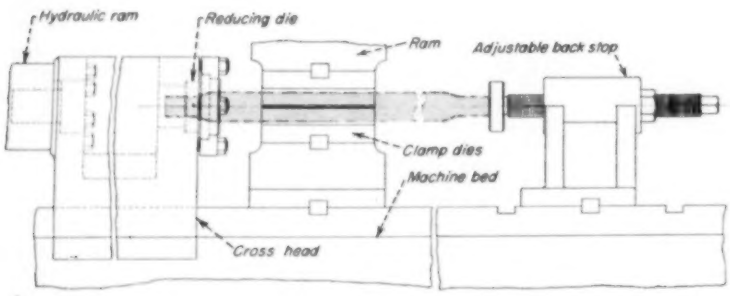
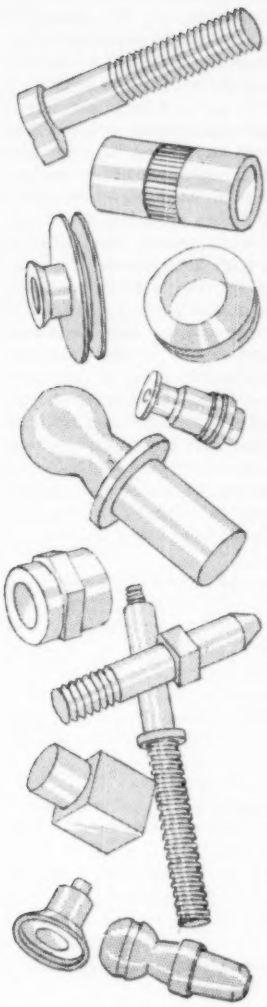


Fig. 14—Tube reducing is often required, but the largest production in the first pass is limited to 28%. To avoid an upset, an operation, once started, must be completed, because metal flow stops

Multiple-Spindle Bar Machines

HOW THEY WORK • WHAT THEY DO



BY MILES J. ROWAN, Associate Editor

ONE of the most common metalworking processes is the machining of parts from bar stock. Engine and turret lathes, hand and automatic screw machines, and multiple-spindle bar machines all have their place in satisfying the varied requirements of thousands of shops throughout the world. Whether the plant is large or small, has job-lot or volume production, works to close limits or average tolerances, there is a suitable bar machine that will turn out work of consistent quality at low cost. Yet, although management is keenly interested in the full range of bar equipment on the market, it is not practical to discuss all machines in one presentation. Therefore, this report concentrates on multiple-spindle bar machines; other bar equipment will be described in later reports.

Because machining requires only the time of the longest single cut on the piece, multiple-spindle automatics are inherently short-cycle, high-production machines. And because of the large number of tooling positions available, they afford excellent opportunities for cutting cost on jobs where operations can be subdivided to advantage. For greater flexibility, attachments can be added. Some greatly increase the range of cutting conditions obtainable on the machine. Others make possible special operations that otherwise could not be performed on the automatic. Frequently, multiple-spindle setups eliminate secondary operations, with considerable savings in direct labor and in overhead. Handling to and from other machines is avoided, work-in-process inventory is reduced, floor space is saved, and investment in additional equipment is lowered. Working all production materials, in all shapes, and up to 7¾ in. diameter, the standard multiple-spindle automatic offers broad opportunities for high production and low cost over a wide range of bar-machine work.

This report explains the basic operating principles of multiple-spindle bar machines. It does not describe the various mechanisms by which different manufacturers control the movements of their machines. These are primarily of interest in setting up the machines and are described in operator's manuals. The report also includes the principles of tooling multiple-spindle machines, the operations that they can perform, and many of their attachments.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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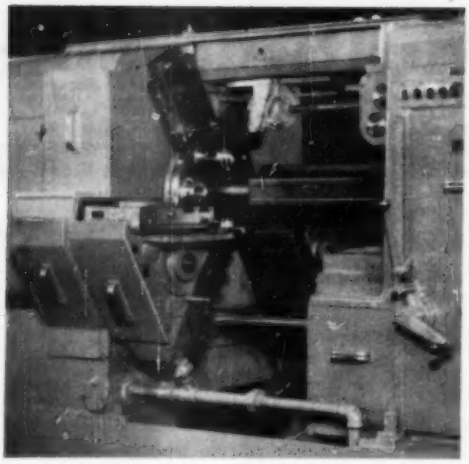


TOOLING AREA

Basic elements of multiple-spindle bar machines include spindle carrier and toolslides. Slides provide mounting surfaces for tools that act upon stock rotating in spindles in carrier

Multiple-Spindle Bar Machines

MULTIPLE-SPINDLE bar machines are made with 4, 5, 6, or 8 spindles. Bar stock rotates in each spindle and all spindles are mounted in a carrier that indexes successively through as many positions as there are spindles.

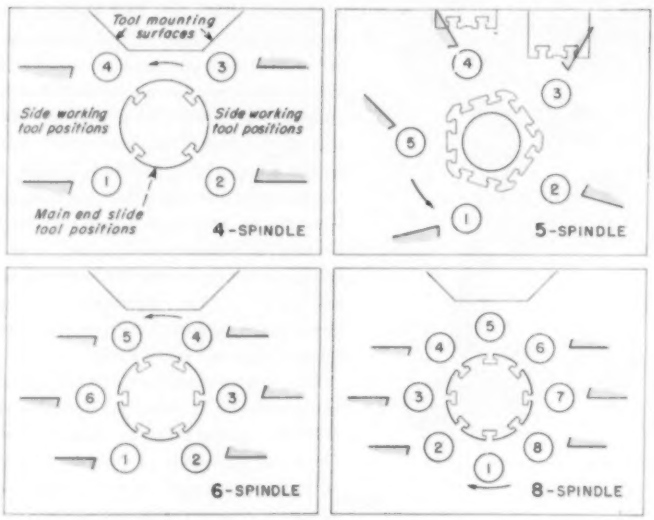
Directly opposite the spindle carrier is the main end slide. This unit has as many tool mounting surfaces as there are spindle positions and travels back and forth parallel to the longitudinal axis of the bar stock. End-working operations, such as drilling or turning, are performed on this slide.

At right-angles to the spindles are the side slides. These offer one or more tooling positions per slide and operate independently of each other. All makers provide at least as many side tool positions as there are work spindles. Forming, shaving, cutoff, and other side-working operations are performed from these slides.

Another type is the "vertical" non-indexing machine with four horizontal work spindles which are parallel and in a vertical row. The machine is primarily for cutoff operations, although it can be arranged for light forming, chamfering, and drilling. It has front and rear cross-slides, and, with a swinging stock stop, can perform two side-working and one end-working operations at each work spindle.

Machines are designated by the the number of spindles that they have and by the maximum diameter of round bar that they can machine. For work over 4 in. in diameter, a four-spindle machine is required. Although models for smaller bars also are built, the largest standard four-spindle machine will accommodate bars 7¾ in. in diameter. The five- and eight-spindle machines, on the other hand, have a maximum standard capacity of 2¼ in. and 2⅝ in., respectively. The six spindle machines include the same class of work as the "fives" and "eights" and, in addition, can accommodate bars as large as 4 in. in diameter. Although only maximum diameters have been mentioned, all machines in each group are made in one or more models, each of which takes a range of bar sizes. It generally is advisable to assign jobs to machines with a maximum capacity as close to the capacity required for the job as possible.

Multiple-spindle bar machines are particularly well-suited to high-production jobs, to jobs on which a large number of operations are required, or on which operations can be divided among tooling positions to save time, and to jobs on which second operations can be eliminated through the installation of attachments.



Spindle and tool positions—Spindles are arranged in symmetrical patterns in carrier that indexes through as many positions as there are spindles. Positions are numbered in direction of indexing, which is clockwise on some machines, counter-clockwise on others. On all machines, end-working and side-working tools can be mounted at each position, although exact location of slide relative to spindle varies depending upon make of machine. Location of position designated as No. 1 also varies with different manufacturers. On some machines, mounting surfaces on top bed furnish additional tool facilities

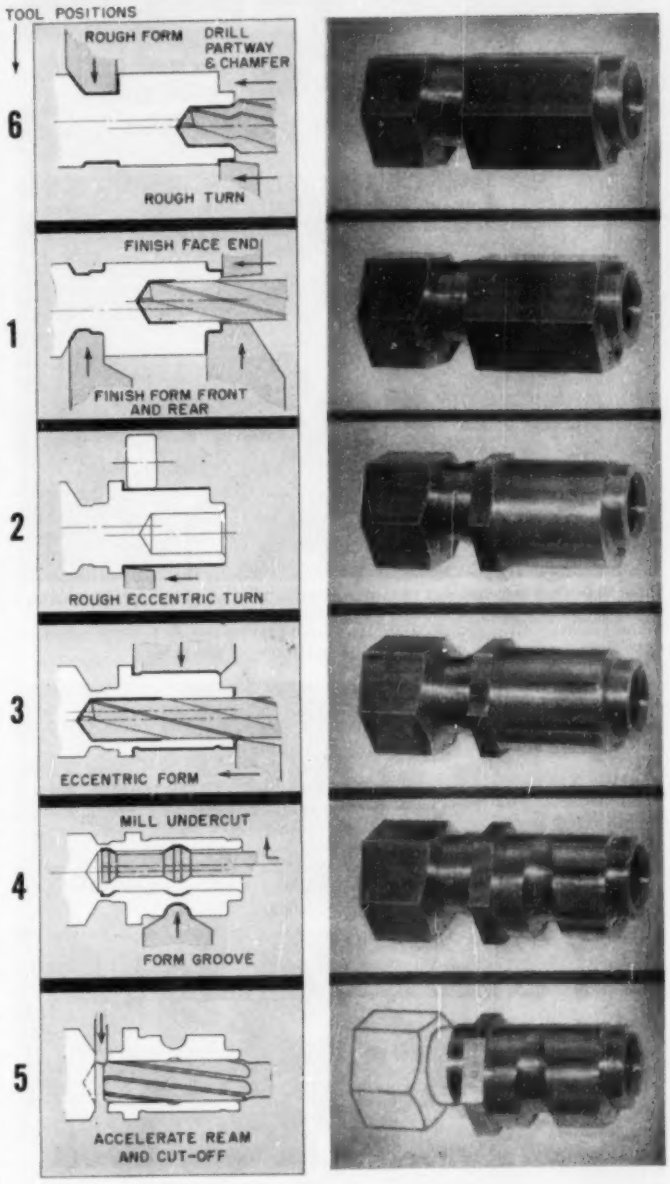
How Do Multiple-Spindle Machines Operate?

ON AN indexing multiple-spindle machine, all operations required to produce one piece of work are performed simultaneously in successive positions. Each tool operates at one position only and consecutive positions are tooled in accordance with the operation sequence on the part. Starting with the first operation at one position, the spindle carrier then indexes to the next position for the second operation, and so on, until the bar passes through all positions of the machine. At the last position, machining is completed and the piece is cut from the bar. The bar then is fed out to the required length and the sequence repeats.

Each time a bar passes through all positions, one piece is completed on that bar. However, as all bars are worked upon simultaneously, every index of the spindle carrier moves a near-complete piece into the position at which it will be cut off. Thus, one piece is completed each time the carrier indexes.

Operating Cycle

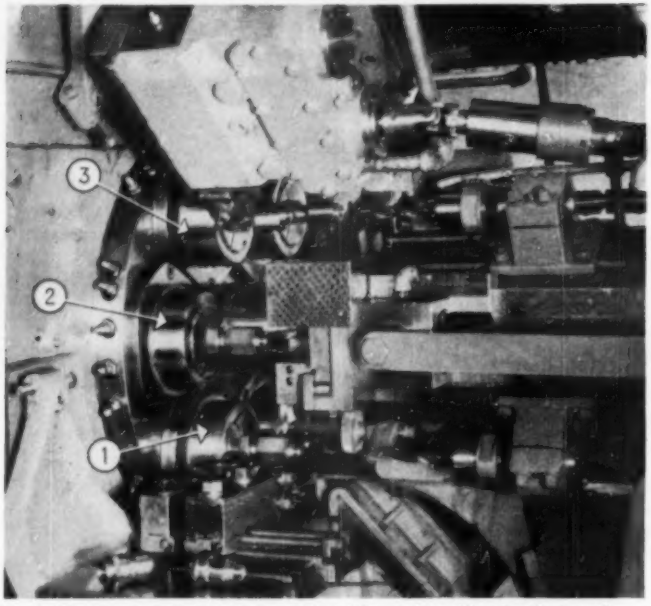
The operating cycle of the machine consists of two parts: The working, or feed, cycle and the high-speed, or idle-time, cycle. The working cycle begins when the cutting tools have advanced at high speed to within a few thousands of the point at which they begin to cut, and ends when all cutting is completed. During this cycle, the machine is driven through change gears that are selected for each setup to provide the desired feed rate on the toolslides. The cutting stroke on each slide is timed so all tools complete their cuts at the same time. (Exceptions to this include tools such as reamers, taps, and die heads, as will be explained later.) Immediately, the machine shifts to its high-speed cycle. Toolslides withdraw rapidly, the carrier indexes, and stock feeds at the feed-out position. Slides then advance rapidly to the point at which the tools are about to contact the bars. At this point, the high-speed cycle ends, and the machine shifts to the speed of its working cycle. The driving speed



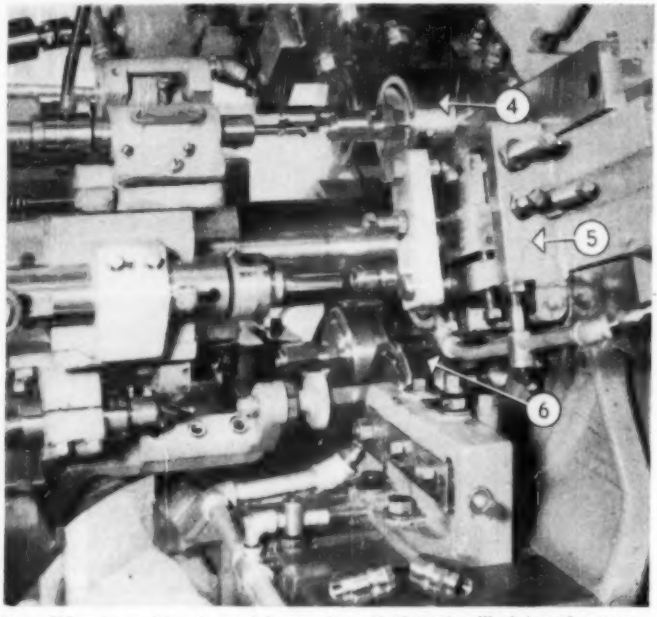
TOOL LAYOUT AND PART DEVELOPMENT

Stock is machined partially at each position, with successive positions tooled in accordance with operation sequence on part. In layout at left, tools are outlined at point of farthest advance on surfaces that each machines. Sequence at right shows how part develops progressively from solid bar at top to completed part at bottom

FOR MACHINE SETUP PLEASE TURN PAGE →



Front Side—Bar is drilled and formed at position 1. At position 2, attachment on end slide turns eccentric, while, at position 3, special unit on cross-slide performs eccentric forming operation. Both are synchronized with work spindles to position eccentrics in correct relation to corners of hex stock



Rear Side—At position 4, special recessing attachment mills internal groove and chamfer. Tool avoids chip interference. External grooving is performed at position 5, and piece is cut off. Bar feeds to stop at position 6. After stop retracts, end-slide tools drill and turn, while cross-slide tool forms part

during the high-speed cycle is constant for all jobs, and the time required for all machine movements occurring during this cycle also is constant. The time of the working cycle, however, is the time required for the longest single cut on the job. Therefore, the time per piece on any job is the time of the longest cut, plus a constant for the high-speed cycle of the machine.

It is important to note that the longest single cut is that cut which requires the greatest number of spindle revolutions. This is not necessarily the tool that travels the greatest distance in making its cut. For example, one tool traveling a short distance at a low feed rate may require more revolutions to complete its cut than another tool traveling a greater distance at a higher feed rate. In this case, the first tool is limiting. This concept is extremely important and it affects not only the time of the job, but also the feed rates on the tools.

Feed Rate

The maximum feed rate on any tool in a multiple-spindle setup depends primarily upon the material being cut, the operation, the material of the tool, the coolant, and the characteristics of the part. Tabulated data giving maximum recommended feeds for various tools are available and serve as a guide in establishing preliminary feed rates on each tool in the setup. Before the actual feed rates are selected, however, the total number of spindle revolutions required for the working cycle must be determined. To do this, the total working travel (in.) of each tool is divided by the preliminary feed rate (ipr) selected for the tool. This gives the number of spindle revolutions required by each tool. The working cycle then must be set to meet the greatest of these requirements.

However, as this number of revolutions also will be available for all other tools (except where multiple cuts, combined cuts, or independently operated tools set up other requirements), it then is possible to reduce the feed rates on all but the limiting tool. This is not always desirable as the re-

duction may cause tools to rub rather than cut. But where it is practical, tool life can be prolonged without a sacrifice in production.

To determine the time cycle of the machine, spindle revolutions can be converted to seconds by a simple formula:

$$\frac{\text{Spindle Rev} \times 60}{\text{RPM}} = \text{Cycle (sec)}$$

Spindle speed (rpm) is set according to the material being cut, the tool material, and the operations being performed; tables of recommended speeds are available. The formula gives the machining time of the job. To this, the idle time of the machine must be added to establish the total production time for the piece.

Stroke Length

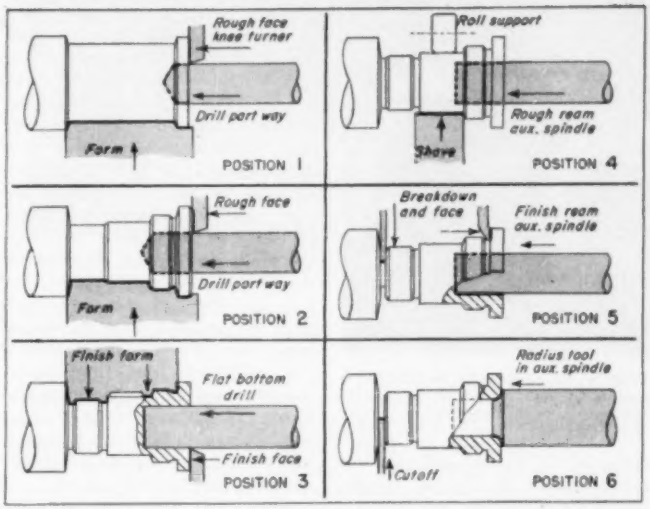
The length of the cutting stroke of the main end slide is fixed by the tool that travels the longest distance in making its cut. When the working cycle begins, the tool is just clear of the work. Other tools clamped on the slide are located in the correct relative positions so all finish their cuts at the same time. However, at certain positions, tools designed with sliding holders can be mounted and operated with a feed stroke and a feed rate that is independent of the main end slide movement. As the side slides operate independently, the stroke of each one can be set individually for the cut being taken.

All toolslides operate against positive stops. The cutting stroke is set longer than it need be for the cut. The slide then is held to the correct travel by the stop, with the over-travel of the stroke going into pressure against the stop. The amount of over-stroke required depends upon the material and the tool. Forming, for example, may require considerable pressure, while shaving normally requires very little. Through this principle, tools cut to dimension consistently.

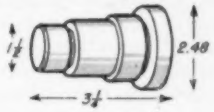
Spindle Speed

Spindle speeds can be changed over a wide range through change gears. For any one setup, spindle speed is constant during the cycle, and is the same for all spindles.

HOW TO PLAN A MULTIPLE-SPINDLE SETUP



MATERIAL: SAE X-1314, 2½-in. DIA BAR
MACHINE: 6-SPINDLE, 2⅜ in.



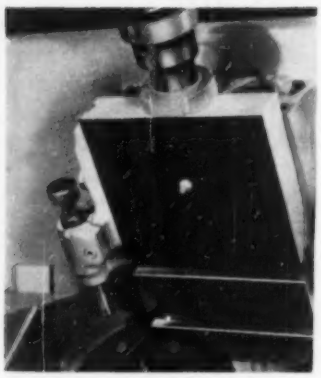
Follow these steps:

- Determine operation sequence and tool layout: as above.
- Select spindle speed: for SAE X-1314, tables recommend 140 sfpm; for 2½-in. bar, 220 rpm is required.
- Determine required length of stroke on tool slides: example—for drills at position 2 & 3 on main end slide, length of cut + allowance for spot in bottom of hole and for facing end of bar = 0.718 in. To this, add 0.032 in. for tension, giving total of 0.750 in. So, ¾-in. stroke is selected.
- Select maximum allowable feed rates for tools: example—from tabulated data, 1⅛ in. drill, cutting X-1314, can be fed at 0.0058 ipr.
- Determine spindle revolutions required for each operation: example—from tabulated data, ¾-in. stroke at 0.0058 ipr requires 119 revolutions to complete its travel. As stroke length and feed rate are known for all operations, each can be figured in same way.
- Establish the working cycle: cut requiring greatest number of revolutions determines length of working cycle. On this job, forming, position 1 and 2, is longest operation, requires 130 revolutions.
- Figure time of production cycle: from tables of data, 130 revolutions at 220 rpm requires 35 sec. To this, add idle time of machine, 3 sec to give total production cycle of 38 sec.

Summary of basic data includes:

SIDE SLIDES			END SLIDES		
Position	Stroke, in.	Feed, ipr	Slide	Stroke, in.	Feed, ipr
1	11/32	0.0026	Main	¾	0.0058
2	11/32	0.0026	Main	¾	0.0058
3	3/16	0.0014	Main	¾	0.0058
4	—	—	Auxiliary	¾	0.0105
5	⅜	0.0029	Auxiliary	1 5/16	0.0105
6	⅜	0.0029	Auxiliary	—	—

SPINDLE: 220 rpm, CUTTING SPEED: 144 sfpm
PRODUCTION CYCLE: 38 sec, MACHINING TIME: 35 sec, IDLE TIME: 3 sec



Positive stop acts against hardened button on spindle carrier to insure accuracy of cross-slide cut

However, in many cases, the effective speed of a given spindle can be changed by mounting a power-rotated tool on the end toolslide. Further, at predetermined positions, spindle rotation can be stopped for cross-drilling, cross-milling, and similar operations.

Bars are held in each spindle by a spring collet, which can be changed to accommodate all standard bar shapes and all bar sizes within the range of the machine. During the stock-feeding operation, the collet is opened, the bars advanced against a stock stop, and the collet is closed. Normally stock is fed in one position only, but feeding at two or more positions can be arranged. Bars are fed against a swing or receding stop that retracts after the feeding operation to provide clearance for cutting tools on the main end slide. Indexing of the spindle carrier is accomplished through Geneva or modified Geneva mechanisms.

In operation, all of these motions must be synchronized with one another and with the movement of the toolslides. Idle-time movements except those specifically requiring adjustment during setup are factory-set. Methods of control and timing vary among the different machines on the market.

Thus, through its basic operating features, plus standard attachments, the multiple-spindle bar automatic affords considerable flexibility for setting up the full range of operations required on bar-machine work. On the vast majority of jobs, it is possible to obtain those operating conditions that provide not only maximum production, but also maximum tool life.

How Are Basic Operations Tooled?

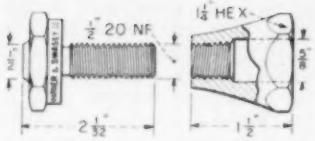
MULTIPLE-SPINDLE machines are inherently high-production units. But their full potential cannot be realized without proper tooling. The real criterion of the effectiveness of any setup is the number of satisfactory pieces in the pan at the end of the run. This is not a matter of speed alone. While cycles should be as short as practical, it is equally important that down-time for tool grinding and tool maintenance also is held to a minimum. Both of these objectives can be realized through proper tooling and planning.

Subdivide Long Operations

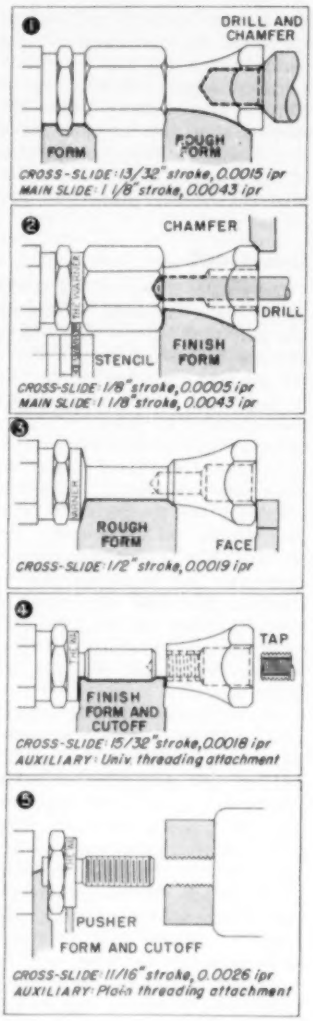
The most important principle of multiple-spindle tooling is to subdivide long operations. Drilling, forming, and cutoff frequently are performed partially at two or more positions. The result is a shorter cycle and increased production.

Subdivision also prolongs tool life. On some operations, tool loads can be balanced so no one tool is subjected to an extremely heavy cut. On others, the greatest amount of material can be removed in roughing cuts, with tools purposely made substantially heavy to stand up under the load. Forming, for example, frequently is done with rough and finish cuts. When planned this way, form tools can be designed with clearance at straight shoulders to avoid the rapid wear that occurs on these cutting edges. Resultant fillets on the work then can be cleaned up in the finish-forming operations.

In addition to these practices relating to subdivision, there are two other features of multiple-spindle operation that also tend to reduce the rate of wear on tools. First, if it is desirable to do so, feed rates often can be reduced below the



TWO PIECES MACHINED IN ONE SETUP



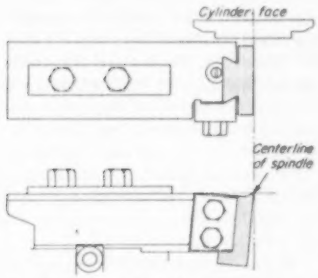
Operation sequence for making two pieces simultaneously from one bar incudes subdivided, combined, and multiple cuts. Chamfer at position 2 is performed with knee turner. At position 4, first piece is cut from bar. Threading at last position is with self-opening die head

maximum possible on a tool. This is done in making full use of all available spindle revolutions, results in no sacrifice in production, and yet establishes conditions that are easier on some HSS tools. Second, coolants are piped to each individual cutting tool and can be directed to the point at which they will do the most good.

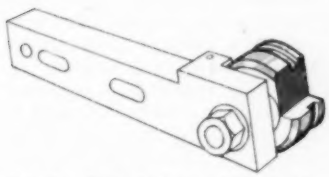
Coolants are particularly important on a multiple-spindle operation and can mean the difference between the success and failure of the tooling setup. Coolants are selected in the usual way to suit the conditions of the job. Data on their application can be obtained from the machine manufacturers.

Take Combined Cuts

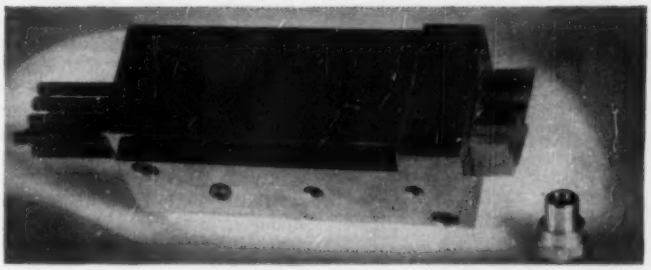
Another major principle of multiple-spindle tooling is to take combined cuts whenever possible. This adds to the number of operations that can be included in one setup and steps up the efficiency of the machine. Operations that often are combined are: reaming, with independently operated slide, and cutoff; tapping or threading and cutoff; drilling and shaving; and turning, with a roller rest tool, and forming. Numerous other combinations also are possible depending upon the requirements of the part.



Dovetail form tool is supported at rear, reduces possibility of interference with other tools



Circular form tool can be ground through 270°, has long tool life



Multiple toolholder forms piece through arrangement of individual toolbits, offers good side clearance

In general, side-working operations that create appreciable pressure on the bar, thus tending to cause deflection, should not be combined with end-working operations unless some support can be provided. Reaming, tapping, or threading, when combined with cutoff, must be completed and clear of the bar before the cutoff operation ends or progresses far enough that the piece may break off during the end-working cuts.

A third principle is to take multiple cuts, with two or more tools working from one position. Forming with individual toolbits in one holder, drilling and facing, and turning and centering are examples of this practice.

Multiple-Spindle Operations

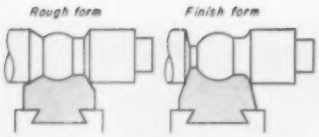
Several of the basic operations that can be performed on a multiple-spindle bar machine also can be done on other machine tools, and all can be performed on other bar equipment. But the methods by which many of these operations are performed on a multiple-spindle machine are not the same as on other equipment. Therefore, although basic operations are described and their purpose explained, the main emphasis is on those tooling principles and practices that are peculiar to multiple-spindle machines.

Forming is one of the most important operations in bar-machine work. Contours that would require several operations with individual cutters can be produced in one or two cuts with properly designed form tools. Furthermore, profiles that are very difficult to produce by any other method frequently can be formed with little or no trouble. In many cases, forming is the fastest method of removing metal; saves on setup, operating, regrinding, and gaging costs; and insures the maintenance of concentricity and dimensional requirements.

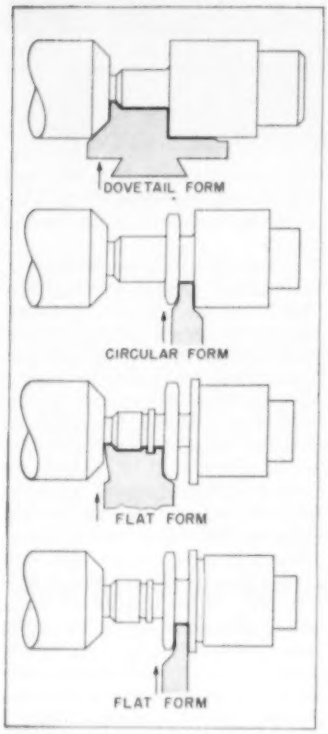
Form tools can be either flat, dovetail, or circular. The flat form tool is simply a standard toolbit which has been ground to the required form. These tools have wide application for grooving, facing, and necking operations. Beyond this, some consider them practical only for simple forming operations on relatively small-lot jobs and regard them as impractical for complicated contours because of the grinding and setup time required. Others, however, claim that with operators skilled in profile grinding they are popular for all kinds of forming operations on any length run. Flat tools can be applied individually or in combination with two or more tools clamped in one holder. They can operate close to the spindle or to tools on the main end toolslide and toolbits often can be carbide-tipped.

Dovetail form tools are made with the desired contour in the full length of the tool face and are set at an angle to the work to provide front clearance. When wear occurs, simply regrinding the top surface restores the cutting edges and the precision of the tool is maintained throughout its life. Dovetail form tools are well-suited to straight-shoulder work as clearance for the cutting edges can be ground on the tool. They are supported at the rear and thus reduce the possibility of interference with other tools in the setup.

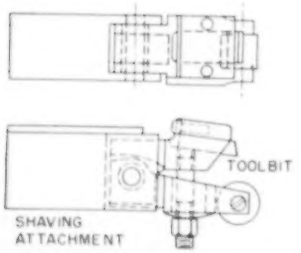
Circular form tools also have a



Form tools should be designed to avoid rubbing on shoulders of work



Forming sequence contains dovetail and circular tools followed by flat tools at positions 3 and 4 to square up shoulders



Shaving tool holds piece to dimension between roller and toolbit

continuous profile and need be ground on only one surface to sharpen their cutting edges. Further, as the circular tool can be reground through approximately 270° of its periphery, it has a much longer tool life than the dovetail tool. Forming with either tool generally is considered practical in widths up to 2½ times the smallest diameter of the formed part.

In multi-spindle work, forming often is divided between two or more tools at different positions. Usually circular tools on rough forming are designed with angles that provide automatic clearance at the shoulders to reduce tool wear on these critical edges. These clearance angles then are removed from the work by a finishing tool at the next position. Shaving or skiving then may follow so the setup meets the requirements of accuracy or finish required on the job.

Shaving is performed primarily for holding close tolerances. As it is capable of holding diameters within a total tolerance of 0.000 to 0.001 in., shaving may eliminate grinding or other secondary operations.

The shaving fixture contains a pivoted holder carrying the toolbit and a roller support. The toolbit approaches the work tangentially and passes over the bar; at the same time the roll passes under the bar. As the holder floats, size is determined by the distance between the roll and the cutting edge. Accuracy is built into the tool and is independent of the machine.

Skiving follows a forming operation and has as its main purpose the production of a fine finish on the work. As skiving tools have no roller and the bit is held solidly, their accuracy is lower than that of a shaving tool. Normally, around 0.002 to 0.003 in. total tolerance can be held.

The skiving tool is ground with a shear angle and takes a shear cut tangentially across the work. As the cut is light and as only part of a form is in contact with the bar at any one instant, only slight pressures are exerted on the bar. Skiving thus may improve concentricity if it follows a heavy forming cut in which some deflection of the bar has occurred.

For plain work and for many forms, skiving gives excellent results. However, the profile of the tool must be compensated to allow for shear and clearance angles. On complicated forms, this can be a difficult task and tool cost thus may become prohibitive.

In planning multiple-spindle tooling, it is well to remember that rough forming followed by shaving or skiving has several advantages over forming complete in one cut. As the form tool need not hold to the drawing limits of accuracy, and as the shaving or skiving tool is taking only light cuts, neither tool requires as close attention from the operator as would be the case if only one tool formed the part complete. Less regrinding is required and tool-maintenance costs are lower. Furthermore, less time is required for the operation.

Turning tools, with the exception of form turners, operate only from the end tooling positions and fall into one of two major classes: knee or roller-rest turners. Both take standard toolbits, which can be set to cut either radially or tangentially.

The knee turner breaks down into three types: plain, reversible, and angular. The plain holder is selected for rough turning or facing and for removal of scale preparatory to forming. The reversible differs only in that it contains two toolbit slots, one on each side of the center bracket of the holder. In the angular holder the blade is mounted at 45° to the collet. Internal chamfering is the major application of this turner. The plain or reversible knee turners have the advantage of leaving the bar open so tools can be brought in from the cross-slide easily.

Rolls on the roller-rest turner support the work against the thrust of the cut. Thus, the cutting tool has greater rigidity than is the case with a knee turner. Closer tolerances can be held, and deeper cuts with heavier feeds can be taken, if the setup permits.

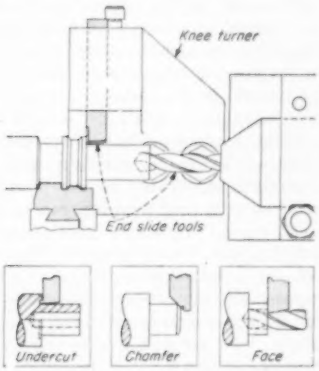
Turning frequently is employed to machine surfaces that cannot be included in the form tool. Width limitations are one reason why it is not practical in some cases to form all surfaces in one tool. An-

other reason is that the difference between the stock diameter and the smallest diameter of the part may require a large number of spindle revolutions if the part is formed complete. Turning the smallest diameter reduces the depth of the forming cut and may save considerable cycle time.

Roller turners with one blade are applied most widely. However, holders with 2, 3, or more blades are available for turning several diameters simultaneously. Likewise, taper and form-turning operations can be performed. Tooling for these operations will be discussed in the section on attachments.

Threading on outside diameter can be done with solid or self-opening dies or with threading rolls. Solid dies need less operating space than the self-opening types, but require a longer threading time as they must be backed off the bar. Because of their speed in operation, self-opening die heads are most commonly selected for all threads that can be cut from the end tooling positions. But for those threads that are behind a shoulder and cannot be reached with a die head, thread rolling usually is employed. Threading behind a shoulder also has been successful with oscillating thread-chasing tools, although this is not common practice.

Self-opening die heads are made to take one of three types of chaser: flat, circular, or tangential.



Knee turning tool leaves bar open for operations from cross-slide. Undercutting, chamfering, and facing also can be performed

All three types can be adjusted to the correct pitch diameter without disturbing the setup. Low chaser cost and ease of resetting makes the flat-chaser die head popular for relatively short-run jobs.

Circular and tangential chasers are sharpened by grinding on only one surface and can be reground repeatedly without destroying the shape of the thread. Both the circular and tangential chasers are well-suited to high production runs.

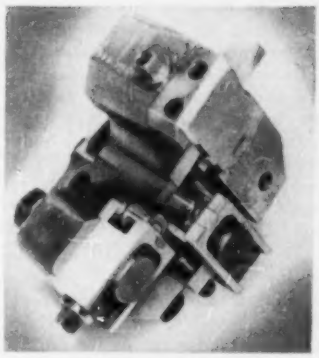
Die heads can be obtained with either rigid mounting, compensating axial float, or radial float. As the floating action makes for better alignment and allows the die to follow the natural lead of the thread without drag, floating die heads produce threads of excellent quality. They are the most popular die heads for general multiple-spindle work. Tapping can be done with either solid or collapsible taps. Floating holders usually are selected.

Chasers can be made either for straight or taper threads. Chaser face angles are determined by the various materials that are cut. However, it is very important to grind chasers on equipment designed for the purpose and in accordance with manufacturers recommendations.

Threading Attachments

As it is not possible to shift to a lower spindle speed on individual spindles on a multiple-spindle machine, the proper surface speed for threading is obtained by driving the threading tool at whatever speed is required to give a relative speed between bar and tool that is correct for the threading operation. Further, as the tap or die must advance according to its own lead, and as this feed rate is seldom satisfactory for other operations on the end slide, a means of feeding the tool independently of the end slide is necessary.

Threading tools, therefore, operate on a slide, the base of which is clamped to either the main end slide or to the machine frame. Mounted on the slide is a spindle-shaft assembly that carries the threading tool and is driven through gearing which can be



Roller-rest turner supports bar during cut, has greater rigidity and holds closer tolerances than knee tool

changed to provide the correct speed of rotation for the tap or die. On some machines this drive is built in, on others it is added. Cam-actuated levers move the slide forward and backward.

Attachments cut either right- or left-hand threads. The tap or die rotates in the same direction as the bar, but at a slower speed than the bar to cut right-hand threads and at a higher speed than the bar for left-hand threads.

Attachments are either plain or dual-purpose. The plain threading attachment drives a threading tool at one forward speed only, and thus requires self-opening dies and collapsing taps. The tool runs on the bar, is tripped by a yoke on the attachment, and is returned by the threading spindle. The unit can be set to trip the tool at any point in the advance motion and to reset the tool as it returns.

The dual-purpose attachment has a double clutch and shifting mechanism for changing the speed of the spindle during the threading cycle. Thus, solid tools can be used. For right-hand threads, the tap or die revolves slower than the work spindle to thread on the bar. When threading is completed, the high-speed clutch engages automatically: the tool rotates faster than the bar and backs off the threads just cut. After the spindle clears the work, the clutch is reset to the slow-speed position for the next threading stroke. Tripping of the clutch can be set at any point in the forward traverse of the thread-

ing slide. Relative threading spindle speeds are in the reverse sequence for left-hand threading.

Universal threading attachments also can be run with self-opening die heads, collapsible taps, and hollow-milling heads. It is only necessary to add a yoke to trip and reset the threading tool and to leave one clutch in engagement continuously.

The advance and return motions of the threading spindle are coordinated by cam-actuated levers. Where possible, advance cams simply start the die or tap on the work. But if the slide is too heavy for the threading tool to pull, the cam must be designed to make the slide follow the tool. The cam must not force the tool, however, as forcing causes stripped threads. The same precaution applies to the return motion when solid tools are used. Return cams take over when threading is completed; and, in conjunction with springs, insure the die returning far enough to clear the work when the spindle carrier indexes.

On some machines it is possible to cut a right-hand thread at one position and, simultaneously, a left-hand thread at another position. It also is possible to cut internal and external threads at the same time at the same spindle.

One manufacturer also has an attachment in which a leadscrew can be slipped over the end of the threading spindle. This unit plus a leadscrew nut actuates the spindle during threading in and threading out.

Thread rolling, essentially, is a cold-forming operation in which metal from a blank finished to predetermined size is raised to correct profile and diameter. This profile usually is a "V", but can be a "U", or some other shape.

The operation is performed with either a single or double thread roll, of which there are various types. The single roll is satisfactory for commercial yellow brass and soft materials, but for steel the double thread roll is recommended. Rolls are mounted in a block that floats in the body of the holder. Both rolls are geared together to keep their separate starts in correct relationship to one another. One roll contacts the work just ahead of the second and provides the initial driving force to the second roll.

The limitations of width and pitch of thread that can be rolled depends upon the strength of the job, including the strength of the work itself and the character of the material, and the ingenuity exercised in planning the layout. For example, thread rolling cannot be done on thin wall tubing without danger of collapsing the piece. Yet, it may be possible to plug or support the work such that the operation is possible. Aluminum and commercial yellow brass can be roll-threaded readily and good results can be obtained on steel that has a carbon content from 0.25 to 0.35%.

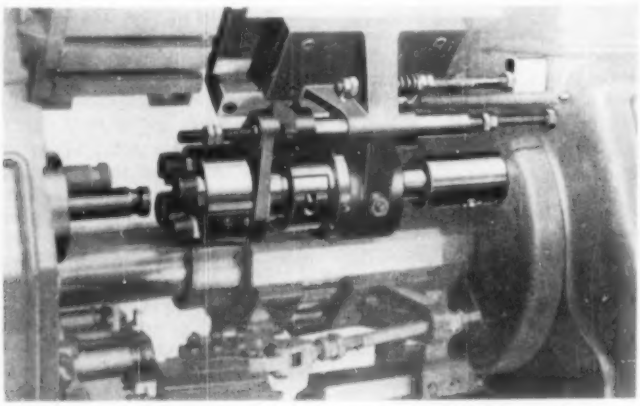
Successful thread rolling requires a blank that has been machined to close tolerances. If the blank diameter is produced by forming, it is good practice to shave before rolling the thread. It is desirable, and, in many cases essential, to support the work during the rolling operation.

In operation, threading rolls are fed to depth as rapidly as possible, and then are permitted to dwell for three or four revolutions of the bar. It is recommended that the dwell section of the cam be a hardened steel insert so it will stand up well under the pressure of the threading operation.

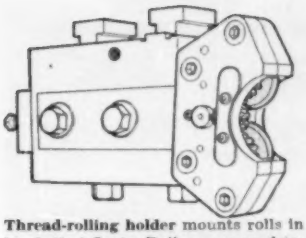
Drilling is one of the most common operations in bar work. As the drilling work on a single hole can be spread over several tooling positions, depths equal to 7 or 8 times the diameter of the hole can be drilled on a multiple-spindle machine in a fraction of the time required with a single drill. Holders can be attached rigidly to the main end tool slide or can be mounted in an attachment that permits a feeding stroke independent of the main slide. A second attachment permits rotating the drills and thus gives a wide range of effective drilling speeds. In all cases, drills should be sharpened by machine if top accuracy is to be obtained.

To start holes concentrically, centerdrilling is employed. In some cases, the operation can be eliminated, but only if sufficient rigidity is present in the setup to avoid objectionable eccentricity in the drilling operation. Normally, all holes under ¼ in. diameter are centerdrilled. Collet chucks that grip the drill near the point can be used to get greater stiffness in drilling. However, if centerdrilling can be eliminated it usually is necessary to devise some other way of chamfering the hole—for example, on a through hole recessing may do the job.

Deep-hole drilling usually is planned so several tools at successive positions share the work in



Threading attachment slides on base attached to machine frame. Spindle assembly carrying self-opening die head is rotated through gearing in drive end of machine at right. Cams provide advance and return motions. Attachments also can be mounted on main end tool slide



Thread-rolling holder mounts rolls in block that floats. Rolls are geared together to keep their starts in correct relationship

End-slide toolholder supports drills, counterbores, or end-working tools that are clamped rigidly to main end slide

such manner that it is not necessary to pull the drills out of the hole during the cut to remove chips and to cool the drill. The first drill takes the major portion of the cut with each succeeding drill starting where the other finished and taking a cut that is not as long as that of the preceding drill. In this way, proper chip clearance and coolant flow is possible. In general, hole depths are divided according to the following plan: centerdrills cut to a depth equal to one hole diameter; then, the first drill cuts to a depth of three diameters; the second, two diameters; the third, one and a half; and the fourth, one hole diameter. This schedule is only a guide; on some jobs, greater depths can be cut with very good results. Likewise, drills that pull out during the operation also have been applied to four-spindle setups.

In planning a drilling sequence, the largest hole usually is drilled first. The smaller drill then can advance almost to the bottom of the hole during the high-speed cycle of the machine. In this way, the feed stroke of the main end slide can be reduced to the minimum required for the longest actual cutting operation. There are jobs, of course, on which the regular lathe practice of "coring out" with a small drill first is advisable to reduce cutting pressure. Yet, in general, it is advisable to arrange operations so the smallest drill removes the least amount of material.

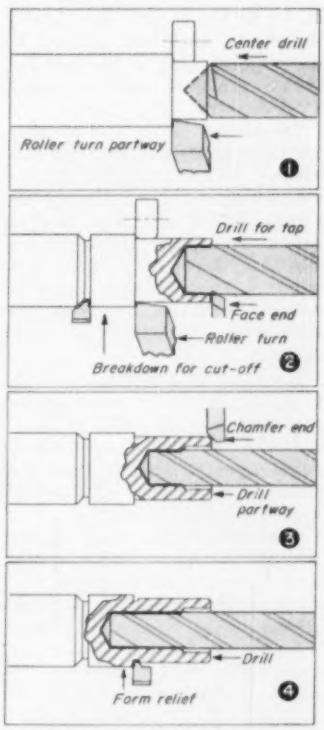
When the hole is the same diameter throughout its depth, it is well to set up the job so each subsequent drill is slightly smaller than the one just ahead of it. This avoids seizing and the possibility of drill breakage as the drill enters the hole just cut. Final sizing of the hole then can be accomplished with a drill or reamer in an independent slide that can be set to ream the hole to full depth in one position.

High-Speed Drilling

If holes are produced with nonrotating drills, the drilling speed (sfpm) is determined by the speed of rotation of the bar stock and the diameter of the drill. Oftentimes, the spindle speed is determined by the requirements of some operation other than drilling and, of course, the drill diameter is fixed by the drawing specifications. Under these conditions, the resultant drilling speed may be considerably less than optimum; this is particularly true of the smaller drill sizes. It also may be that the feed required by another operation on the main end slide is too high for the drills. To overcome either of these difficulties and to provide the right conditions of speed and feed, a high-speed drilling attachment can be mounted on the main end slide.

In a high-speed attachment, drills rotate in a direction opposite to that of the spindle, thereby increasing the effective drilling speed. For example, with a spindle speed of 1915 rpm and an attachment rotating at the same speed in the opposite direction, the effective drilling speed is 3830 rpm. High-speed attachments can be set in any position and the ratio of attachment speed to spindle speed can be varied over a wide range through change gears. With the stock rotating in the forward direction, drill angles are the same as for conventional right-hand drilling.

High-speed drilling attachments either are mounted on and have the same feed rate as the main end slide, or have independent actuation through cam and lever. When taking the feed of the main end slide, an increase in the speed of drilling normally permits an increase in feed on the main end slide, providing this does not interfere with end-working operations at other positions. However, if the feed rate is fixed, an increase in the effective drilling speed results in a decrease in the feed of the drill per spindle revolution. For example, if the feed rate on the main slide is 0.004 in. per revolution of the spindle, a high-speed drilling attachment with main end



Drilling sequence is divided over four positions. Larger hole is drilled first

slide feed and running at 100% of spindle speed, in effect, reduces the feed on the drill to 0.002 in. per spindle revolution.

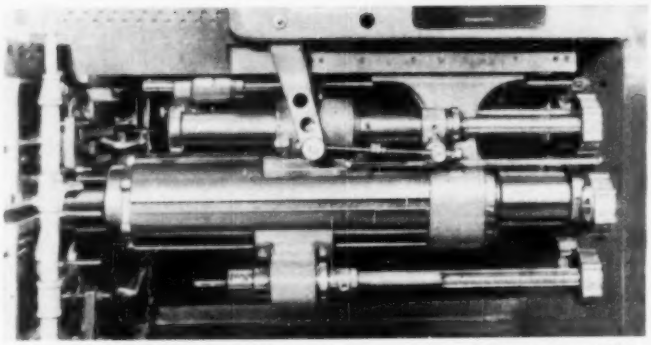
Reaming produces an accurately sized hole with a smooth finish. As reamers are mounted in a holder with some parallel and angular float, the tool follows the hole and automatically corrects for any misalignment between the spindle and the end toolslide. Accurate sizing thus can be obtained regardless of small machine errors that result from indexing the spindle carrier.

On multiple-spindle machines, reaming frequently completes, in one position, a hole that has been drilled partially at each of several preceding positions. The reamer is mounted on an independently operated slide on the main end slide and is fed at the rate required to complete the operation in the number of revolutions available. As this often requires a fast feed rate, it is well to check the actual feed per blade by dividing the total feed rate of the slide by the number of blades on the reamer. Each blade shares the total feed equally. If the required feed is too high for the tool, it may be possible to select a reamer with more blades.

Trepanning is an end-forming operation performed from the end cutting position with one, two, or four blades in one toolholder, or a form tool. The cutting face of each blade is ground to the contour desired at the bottom of the cut. A major problem in trepanning is to remove chips from the hole, yet support the cutting blades satisfactorily.

Knurling is similar in principle to thread rolling, but in many cases the tolerances are not as close. Knurling can be performed either from the end slide or the cross slide. Straight, spiral, or diamond knurls can be produced.

Burnishing consists of passing two rolls across the work to produce closer tolerances and a mirror-like finish on previously machined surfaces. One roll passes over the work, the other passes under; the distance between the two rolls is fixed, and they float in their holder the same as a shaving tool. As burnishing removes no metal but only displaces slight feather-edge projections in rolling them into a smooth surface, it is very important that the machined dimensions are to close tolerance when the operation begins. Otherwise, excessive strain occurs on the rolls with the possibility of broken or damaged pins. For this reason, work should be shaved before burnishing is attempted. Contours as well as plain diameters can be burnished. Face burnishing and internal burnishing also can be done from the end toolslide. Burnishing often eliminates an expensive secondary operation for grinding to finish specifications.



End-working spindle attachments take travel of main end slide or have different feed rate through separate lever actuation. Live spindles are rotated through splined shafts by attachment gears

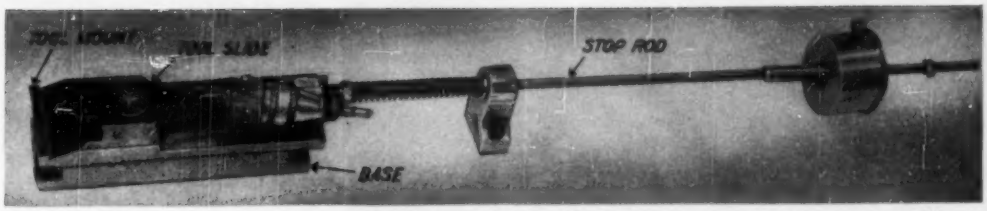
Cutoff tools are either blade or circular. The blade cutoff is selected for straight cutoff operations where rounding or forming of the end of the bar or of the completed part is not required. Blade tools also are set up in positions other than cutoff for necking, grooving, or partial cutoff.

Can Carbides Be Applied?

Although tools on multiple-spindle bar machines for the most part are high-speed steel, carbides are coming into the picture. However, at present, caution must be exercised to make proper applications. One of the problems with carbides is to maintain proper cutting speeds for satisfactory tool life. This is a problem on a multiple-spindle machine because all spindles rotate at the same rpm, while on other bar machines spindle speeds can be changed. Furthermore, on multiple-spindle machines, combined cuts often are made on diameters of different size. It frequently is difficult to establish on both surfaces cutting conditions under which carbide tools will stand up properly. If carbides are selected for the OD and HSS for the smaller diameters, the problem then becomes one of obtaining a coolant satisfactory for both materials. The question also arises as to whether the cutting time of the HSS tools can be fast enough to take full advantage of the cycle reductions made possible by the carbides.

Another factor is that rubbing action on cutting edges must be avoided. Carbides should not dwell or remain stationary against the bar, as tool wear is rapid if this occurs. Therefore, backlash must be eliminated from slidedriving mechanisms. The tool must feed as soon as it reaches the work, without a delay to take up idle movements in the drive. Machines, therefore, must be in good condition.

There are numerous jobs, of course, on which conditions are satisfactory for carbides. These provide a background of experience that serves to guide future applications. For example, drilling is one of the more difficult operations for carbides. Yet, several different drills have been developed and have proved satisfactory on given jobs. Thus, although there has been no standardization of carbide tools for multiple-spindle bar machine work, the possibilities of carbides should not be overlooked in planning job setups.



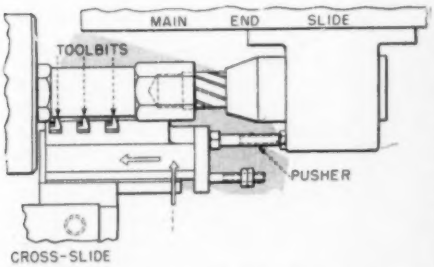
Recessing attachment contains internal cams that provide lateral movement to cutting tool. Cams are actuated as base moves while toolside is halted by stop rod

Attachments Add Flexibility, Cut Second Operations

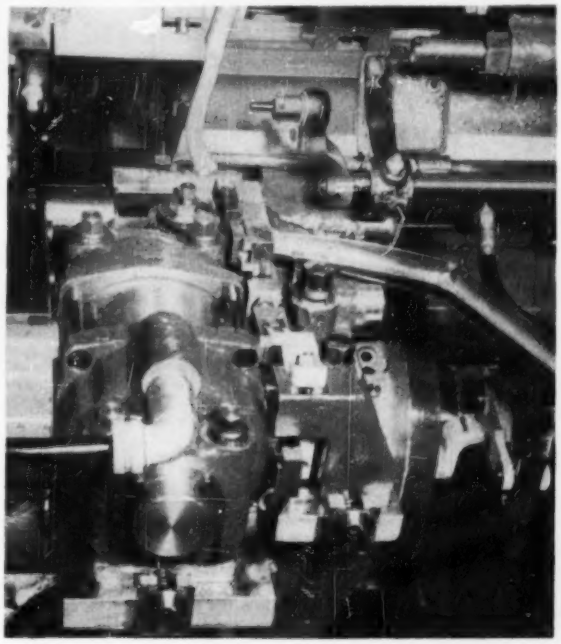
ATTACHMENTS include a vast number of units developed particularly for multiple-spindle operation. Many of these units, though properly segregated from standard tools, are widely used and are generally accepted as common practice. They can be changed over for a wide range of jobs, can be operated in more than one tooling position, can be added or removed at will by the setup man, and actually are little more than an advanced toolholder that provides greater flexibility in the operation of the machine. Included in this group are attachments for: high-speed drilling, accelerated reaming, threading, tapping, recessing, form-turning, taper-turning, combined taper-turning and taper-boring, and eccentric-boring. Of these, the first two provide more favorable cutting conditions on standard operations, often with resultant shorter cycle time and longer tool life. The remainder are necessary to perform the operation for which they are intended. The operating sequence of attachments for high-speed drilling, accelerated reaming, threading, and tapping were explained in the section on basic operations.

Recessing

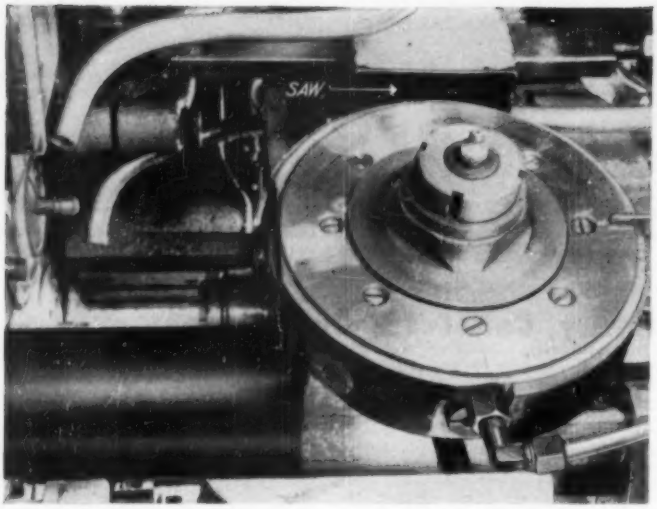
Internal grooving, necking, or chamfering is done with recessing tools. These are mounted in fixtures on the end toolslide and are available in several types. One fixture consists of two members, one of which holds the cutting tool; the other is attached to the main end toolslide and provides ways in which the first can slide. In operation, both members move together until the cutting tool reaches



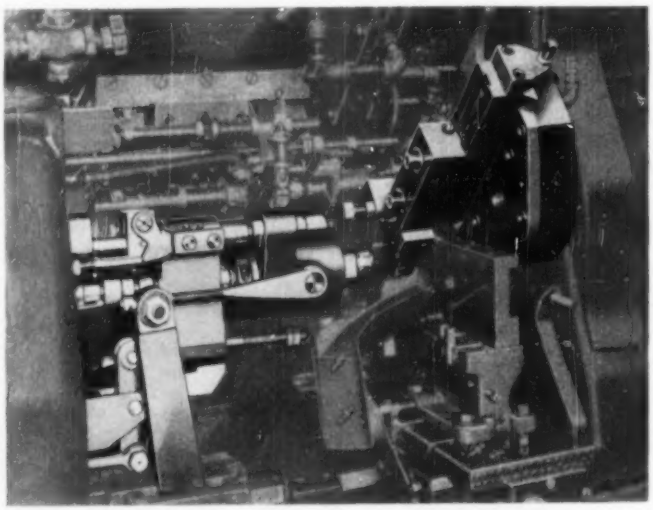
Form-turning attachment is fed to depth by cross-slide, then is advanced along bar by end tool slide. Attachment permits avoidance of wide plunge cuts, turns long diameters with shorter main end slide stroke



Pick-off arm grips bar until piece is cut off, then drops back and swings to milling fixture. Arm advances to position piece in fixture, then drops back for next piece. As motor-driven attachment moves forward under control of cross-slide cam, toggle closes jaws to clamp piece for cut by two milling cutters and one slotting saw. After cut, piece drops into chute



Drum pick-off carries piece during slotting operation. Drum advances independently of main end toolslide to position one of eight bushings over piece. After cutoff, drum retracts, indexing ⅛ turn through ratchet and pawl. With one piece in position, saw at top feeds down for cut, then withdraws for indexing. Pieces are ejected by air at lower position



Rotating pick-off attachment is mounted on main end slide but moves independently to and from spindle. Attachment contains collet that closes on work just before cutoff. As attachment moves back, collet opens and internal ejector expels piece. Rotation of pick-off spindle and work spindle is synchronized so collet can grip on square, hex, or other shapes

the point at which the internal groove is to be made. At this position a stop rod attached to the machine frame halts the member that holds the cutting tool, while the other member continues along with the stroke of the main end slide. The cross-slide then moves in to swing the tool into the bar for the cut. This is satisfactory for chamfering or similar unrestricted cuts, as the swinging member is free to return to the axis of the work and can be withdrawn when the cut is completed. But for grooves with straight sides or contours that tend to bind and to hold the tool in the cut, a positive means of returning the swing member to the work axis is desirable. For these applications, a holder with a self-contained camming mechanism to move the tool into and out of the cut is advisable. In this case, the travel of the moving member past the stopped member actuates the mechanism and no action from the cross-slide is required. A third recessing toolholder has a rotating cutter, similar to a small milling cutter. This has the advantages of keeping the chip load per tooth light and of providing better chip removal.

Stenciling

Characters can be rolled in pieces with attachments in which a stenciled roller is held in contact with the bar for only one revolution of the piece. For average work, the roll is set on center and is advanced by the cross-slide. The roll contains a flat and, after stenciling is completed, is locked out of contact with the bar. During the return stroke of the cross-slide, a stationary bar releases the lock on the roll so a spring can reset the roll for the next cycle. For heavy work, the cross-slide can be locked in position and the roll can be set to contact the bar during indexing.

Although the design details of attachments differ considerably, in general, the basic motions that the common units make possible and the methods by which they operate are these: (1) The cutting tool can be mounted on a slide that can be advanced a different distance and at a different rate from the main end toolslide; reamers often are set up this way. (2) The cutting tool can be mounted in a power-rotated spindle to change its effective cutting speed; the spindle can be attached rigidly to the main end slide or can be fed independently. (3) The cutting tool can be mounted in a holder consisting of two movable members, one of which can be stopped at any point as the toolslide moves forward; the other then continues on, im-

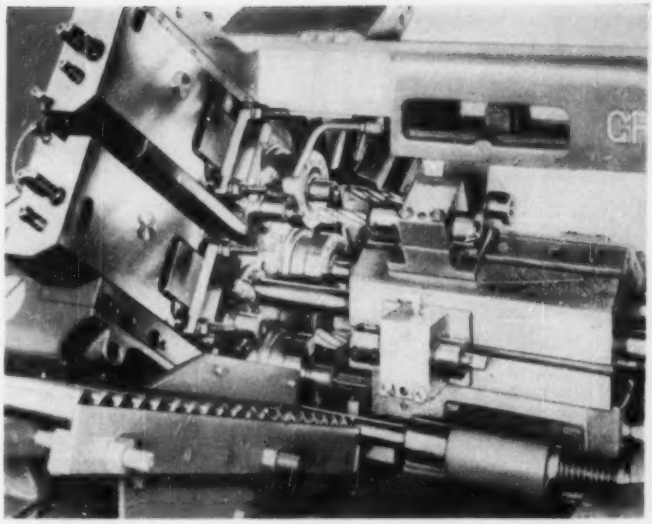
parting a transverse motion to the stopped member and thus moving the cutting tool into the work. This is the principle of several designs of recess, or internal necking, tools. (4) Longitudinal and transverse motions can be imparted to a two-part holder simultaneously from the end- and cross-slides, as in form-turning.

Pick-Off Attachments

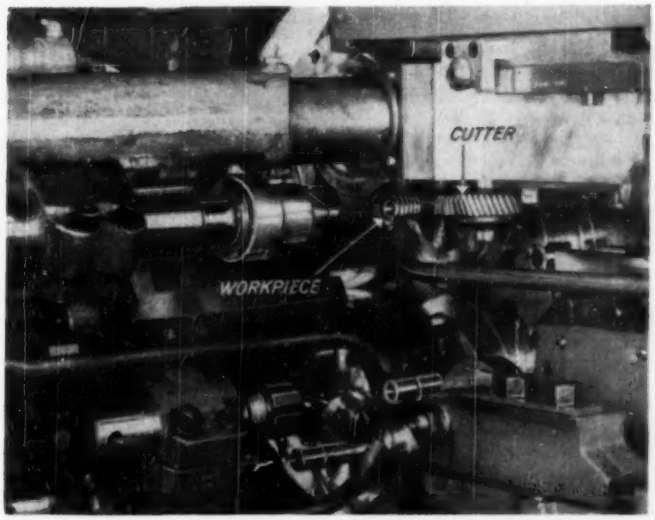
Also commonly applied are pick-off attachments and magazines. Pick-off attachments normally operate in conjunction with another attachment, such as a burring or cross-milling unit. Secondary operations often can be eliminated with such combinations. The pick-off attachment supports the part as it is cut from the bar, then transfers it to the second unit. The transfer can be made either with a swinging arm, a drum, or auxiliary spindle. Pick-off attachments also may be applied to support work during cutoff to eliminate the cut-off burr. Another application is back center-drilling. The pick-off moves the piece against a dead drill on the cross-slide.

Pick-Off and Reload

An interesting application is an attachment by which a piece is picked off the bar at one position, turned around, and placed in the collet at the next position for added operations on the other end. The head on the attachment receives the piece as it is cut off at one position, say 5; the head then is rotated 180° by a lever-operated rack and pinion to bring the opposite end of the piece in alignment with the open collet at the next position, 6. An air-operated plunger on the end tool slide pushes the piece into the collet. The head then swings back for the next cycle. The machine double indexes, with operations performed on one end at positions 1, 3, and 5—five being the cutoff—and the other end at positions 2, 4, and 6—with spring ejection of the completed part at six. The attachment is mounted on the cross-slide.



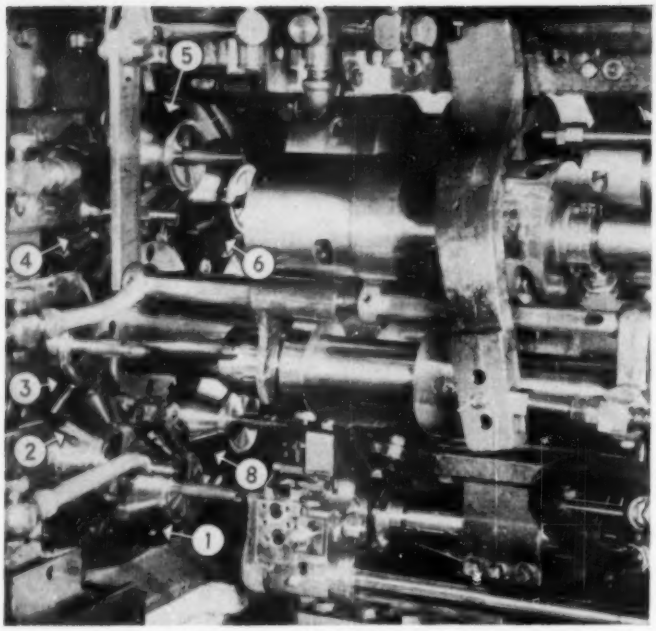
Gravity magazine is mounted on cross-slide and advances to align piece with spindle for loading. Air-operated plunger pushes piece into collet against stop. Collet closes and magazine withdraws. Ejection is automatic when collet opens

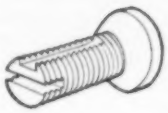


Worm generation is performed at position 4 to produce piece with left-hand thread, 0.800-in. OD and 20° pressure angle. Cutter rotates in constant relation with spindle rotation and is fed into bar by motion of cross-slide. Piece is recessed and faced at position 5 and is supported during cutoff at position 6

Magazines

Magazines make it possible to perform secondary operations on a multiple-spindle bar machine. Gravity magazines that mount on the cross-slide move forward to bring the part into alignment with the spindle. With the collet open, a plunger from the end-working position pushes the part into the spindle against a stop. The collet closes and the magazine withdraws, its movement being controlled and timed by the cross-slide cam. When the part is machined, an internal ejector expels the piece from the spindle before the plunger pushes the next one forward. The plunger





Milling without stopping spindle is performed with end-working auxiliary spindles driven at speed that synchronizes with work-spindle rotation. After threading at position 3, slot is milled across face at position 4, second slot is milled full length of thread at position 5, and thread is chased at position 6 to clean up burrs from milling. Chuck in auxiliary spindle at position 8 picks off piece so cutoff is made without burr on back of piece

can be attached to the main end toolslide or can be operated independently.

There are numerous variations on this basic idea to suit the particular conditions involved. For example, chain, hopper, and drum magazines also are made. Some mount on the cross-slide; others feed from the rear through the work spindle. However, all contain the same fundamental elements: a means of aligning the piece with the spindle, a plunger to push it into the spindle, a stop for correct positioning, and an ejector for expelling the machined piece.

Other Attachments

Other attachments of a more specialized nature include cross-drilling, cross- and end-milling, worm-generating, eccentric-drilling and eccentric-turning. Some of these special operations are performed on the cross-slide, others from the main end toolslide. If any rotating tool on the cross-slide must pass through the bar, as in cross-milling, the spindle must be stopped during the cut. This also is true of some end-working attachments. Spindle-stopping is accomplished by mechanisms assembled at the rear of each work spindle to permit braking the spindle. Carried to the ultimate, the spindle carrier becomes a work-holding fixture which advances stock through the machine positions for operations by power-driven tools at each station. Jobs have been setup in which the spindle was dead during the entire cycle, with cutoff accomplished by a powered saw on the cross-slide. However, end-working attachments are made in which several operations can be performed without stopping the spindle. Included are: end-milling, cross-milling, cross-drilling, multiple hole end-drilling and tapping, stamping, and eccentric hole drilling.

Cross-Drilling

Cross-drilling without stopping the spindle is performed with an attachment which rotates at the same speed as the work spindle. The drill is mounted radially to the bar and is driven by internal gearing actuated by the rotation of the head. Camming in the attachment provides the radial movement to the member in which the drill assembly is mounted. The unit can be positioned axially and circumferentially as desired. Cross-milling without stopping the spindle is done by the same principle.

Eccentric-Drilling

The principle of drilling an eccentric hole without stopping the spindle is to hold the drill eccentric with the toolholder; when the holder rotates about its own center, the drill then describes a circle equal in radius to the amount by which the drill is eccentric. The rotation of the sleeve then is synchronized with the speed of the work. In this way, the drill travels the same path as the center of the hole being drilled.

Units of this type are built by the manufacturer to meet the user's specifications. Some are entirely special, designed for a particular job and good only for one operation. Others, though essentially special purpose, have some flexibility. For example, it may be possible to change over a cross-drilling attachment for different size holes, and so on. Actually, through attachments, almost any metal-cutting operation can be performed on a multiple-spindle bar machine.

Acknowledgment

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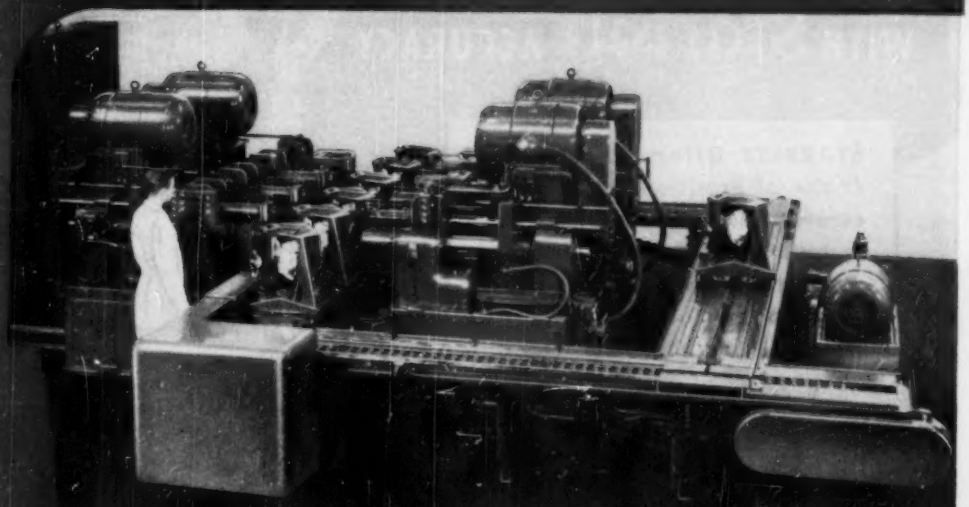
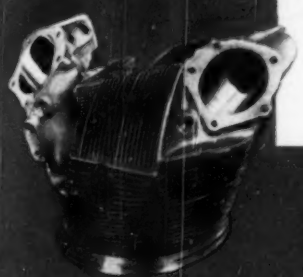
The Warner & Swasey Co.

Another Transfer-matic by Cross



Drills and Bores Aircraft Cylinder Heads



- ★ 80 pieces per hour at 100% efficiency
- ★ 5 stations—1 loading, 4 cutting
- ★ Rough drills and forms valve pockets and spring compartments; finish bores valve guide hole, insert seat and spring seat
- ★ Palletized work holding fixtures with interchangeable adapters for holding four parts
- ★ Stub tools for drilling and forming—no drill or guide bushings
- ★ Coolant directed through spindles and tools to cutting points

Established 1919

THE **CROSS** CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

GET THE "HOLE" STORY WITH Starrett ACCURACY

STARRETT Offers The Widest Choice of Precision Tools for Accurate Inside Measurement. For complete information, see your Starrett Distributor or write for Starrett New Tools Booklet.

SMALL HOLE GAGES NO. 829
For fast, accurate small hole gaging — supplements No. 229 Telescoping Gages. Four gages in handy red leather case. Range, 1/8 to 1/2 inch. Quick adjustment and sensitive contact makes it easy to feel small dimensions accurately and transfer to a micrometer.

NO. 830 HOLE GAGES (SHORT TYPE)
Especially adapted for work in close quarters, shallow holes and slots, between work and machine spindle, etc. Note shorter length and radial shaped contact. Total capacity, set of five gages, in convenient red plastic case, 1/8 to 1/2 inch.

TELESCOPING GAGES NO. 229
Made to measure holes from 1/2 to 6 inches — shrink, close or loose fits. Ideal for transferring internal measurements to micrometer or outside caliper. Plunger locked or released by knurled screw. Set consists of five gages.

INSIDE MICROMETER CALIPER NO. 823 With No Glare Satin Chrome Finish
Both this caliper and the No. 124 below offer a choice of two excellent tools. No. 823 is a popular model preferred by some mechanics for its larger diameter rods and anvils. Rods are centerless ground steel tubes lightweight yet rigid for nice balance and feel. Each rod marked for length and adjustable for accuracy. Micrometer head has 1/2" movement with all thousandth lines numbered. Patented handle furnished provides correct reach and balance. Set A, 1½-8". Set B, 1½-12".

INSIDE MICROMETER CALIPER NO. 124 With No Glare Satin Chrome Finish
An old favorite with mechanics and machinists for internal and linear precision measurements and for setting calipers comparing gages, etc. Set includes a micrometer head with 1/2" movement, solid extension rods, spacing gage, auxiliary handle and spanner wrench. Capacities: Set A (shown), 2-8 inches; Set B, 2-12 inches; Set C, 8-32 inches; Set D, 2-32 inches.

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American Machinist

REFERENCE BOOK SHEET

Approach Distance for Milling Flats

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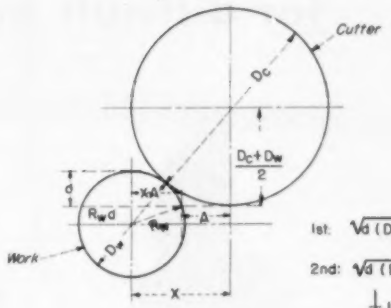
BY V. G. HOTCHKISS, Industrial Engineer, DEERE & CO., MOLINE, ILL.

1st: Work dia minus depth of cut = $D_w - d$

2nd: Cutter dia plus work dia minus depth of cut = $D_c + D_w - d$

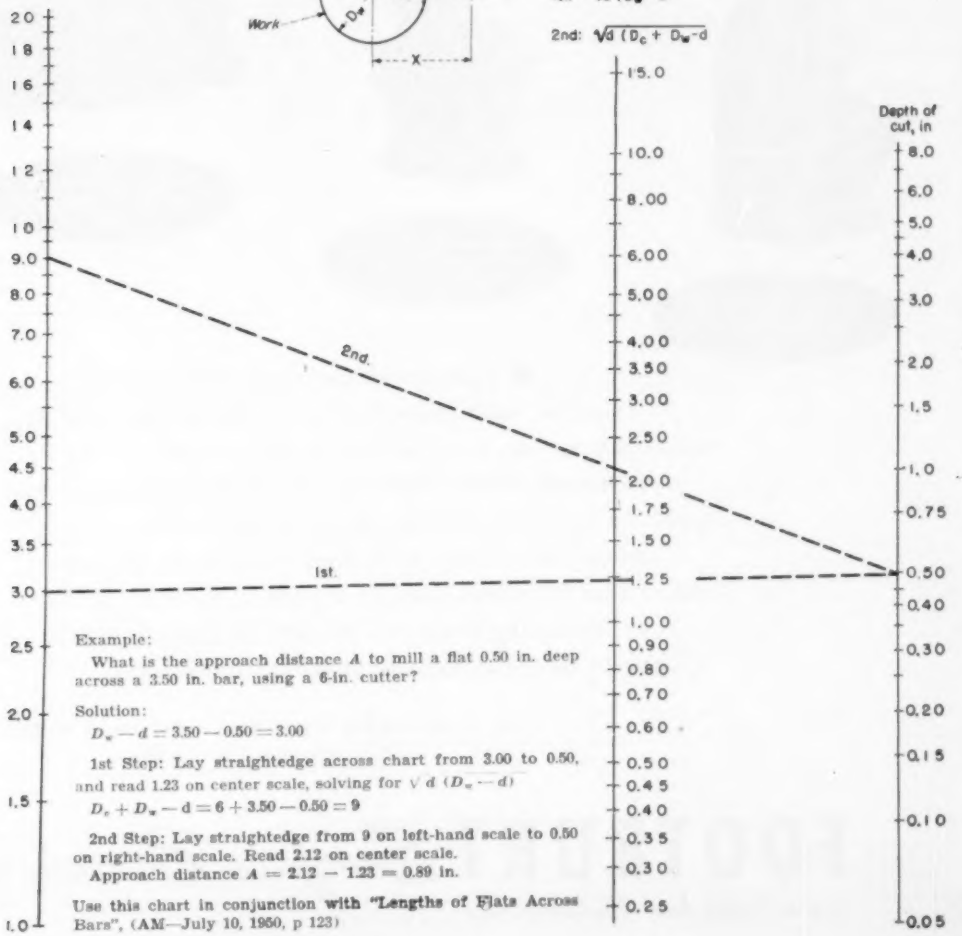


Approach distance:

$$A = \sqrt{d\,(D_c + D_w - d)} - \sqrt{d\,(D_w - d)}$$

1st: $\sqrt{d\,(D_w - d}$

2nd: $\sqrt{d\,(D_c + D_w - d}$



Example:

What is the approach distance A to mill a flat 0.50 in. deep across a 3.50 in. bar, using a 6-in. cutter?

Solution:

$D_w - d = 3.50 - 0.50 = 3.00$

1st Step: Lay straightedge across chart from 3.00 to 0.50, and read 1.23 on center scale, solving for $\sqrt{d\,(D_w - d)}$

$D_c + D_w - d = 6 + 3.50 - 0.50 = 9$

2nd Step: Lay straightedge from 9 on left-hand scale to 0.50 on right-hand scale. Read 2.12 on center scale.

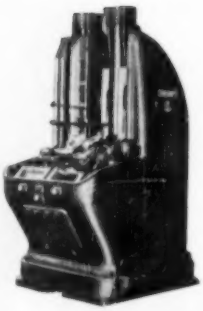
Approach distance $A = 2.12 - 1.23 = 0.89$ in.

Use this chart in conjunction with "Lengths of Flats Across Bars", (AM—July 10, 1950, p 123)

investigate

Surface Broaching

for difficult machine work



Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

Continuous Type Broaching Machine. Made in 4 Sizes.

★ Throughout the metal working field there are many parts that can be surface broached at remarkable savings over the cost of the present machining method. The aircraft, automotive, small tool, appliance and even sporting goods manufacturers have all found ways of making parts faster, cheaper and to finer tolerances through the use of Footburt Surface Broaching Machines. We will be glad to work with you on the application of surface broaching.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

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FOOTBURT *Surface Broaching*

a time tested line of machine tools

Rules for Dimensioning..!

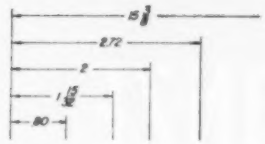
These practices are followed by the automotive industry

Dimensioning is the art of imparting definition to a pictorial representation. A detail drawing, when it is dimensioned intelligently, should represent the part as it is to be received by the inspection department, regardless of its source of manufacture. It should usually deal cautiously with the method of manufacture, specifying the result to be obtained rather than the method of obtaining it, in order to permit the maximum latitude in optional methods of manufacture. It should be so dimensioned as to insure interchangeability of parts.

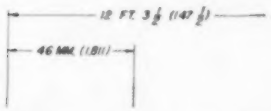
The following general rules form a basis for intelligent application of dimensions:

1. Plan the location of dimensions in an orderly, uncrowded arrangement.
2. Dimension the piece rather than the picture.
3. Be sure that the dimensions and their relation to one another express the engineering intent clearly.
4. Use sufficient dimensions to define accurately the size of every portion of the represented part.
5. Leave nothing to judgment of the user.
6. Select a method of dimensioning which will insure interchangeability of parts from multiple sources without rejection of usable material.
7. Every drawing should be dimensioned so that it will stand up in any court of law as a clear, uncontroversial statement of all that is required.
8. Keep the dimensions outside the outline of the part, wherever possible.
9. Avoid duplication of dimensions, because a duplicate dimension may be overlooked when changes are made.
10. Where gaging is necessary, specify clearly the extent and relation of gage inspection required and the amount of variation which the gage may allow.
11. Avoid crossing dimension lines with witness lines or leaders to notes, wherever possible.
12. Dimensions should be given a liberal tolerance wherever possible.

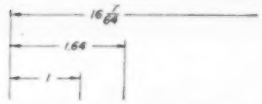
UNITS OF DIMENSIONING



Dimensions on all drawings should preferably be given in inches and fractional parts of an inch. The fractions may be expressed either as common fractions or decimals.

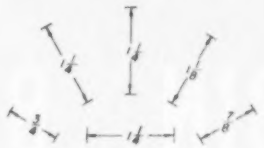


Where peculiarities of the product require dimensions to be given in feet or in metric increments, only that portion of the dimension not expressed in inches should be designated as feet, millimeters, etc. The equivalent in inches may be shown.



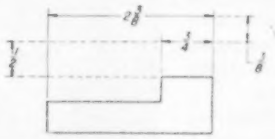
The term "inches" or its symbol is not used in connection with linear dimensions.

POSITION

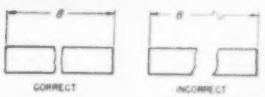


All dimensions are placed to read in a horizontal position, wherever possible, regardless of the direction of the dimension line.

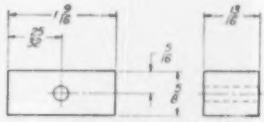
DIMENSION LINES



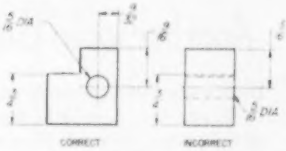
Dimension lines are spaced a reasonable distance from the outline of the part to present a good appearance, approximately ½ in. They are spaced uniformly relative to one another—preferably not less than ¾ in. apart.



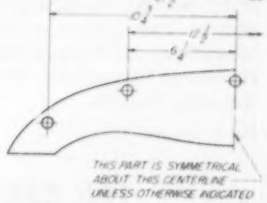
Dimension lines are not broken when dimensioning a part which is broken.



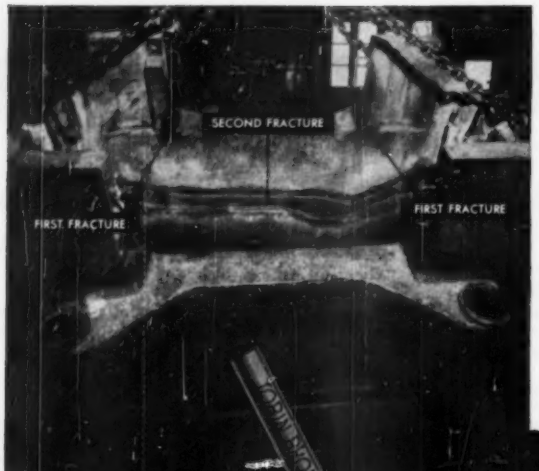
Dimensions are placed outside the outline of the part and between the views wherever possible. Where centerlines are used as witness lines, they are shown as such beyond the outline of the part.



Dimensions are shown in the true views and taken from visible outlines wherever possible and not from hidden edges. Hole-locating dimensions and hole sizes are shown in the plan view of the hole wherever possible.



On drawings of symmetrical parts where only one half of the part is



36-foot fracture welded!

An example is the oxyacetylene braze-welding of a 36-foot fracture in this 10-ton blank holder. The casting had fractured before and was braze-welded by the Super Arc Welding Company, Detroit, Mich., using Tobin Bronze. When it broke the second time, a 36-foot fracture, the old weld was not affected. The same company again repaired it . . . naturally with Tobin Bronze.

The bigger the weld, the more you need TOBIN BRONZE

The larger the weld the more chance there is for thermal stresses to create danger of warping or cracking.

So the bigger the job, the more important it is to use Tobin Bronze—which welds at relatively low temperatures. You don't have to pour in so much heat . . . high stresses can't build up.

Another Tobin Bronze job!

Here's another Tobin Bronze* repair job by Super Arc . . . welding multiple fractures of an 18-ton crown from a stamping press. Again Tobin Bronze proved its worth for fast, low-cost, dependable welding.

There are ANACONDA Welding Rods for many types of repair and production jobs. ANACONDA Welding Rods are available from distributors throughout the United States. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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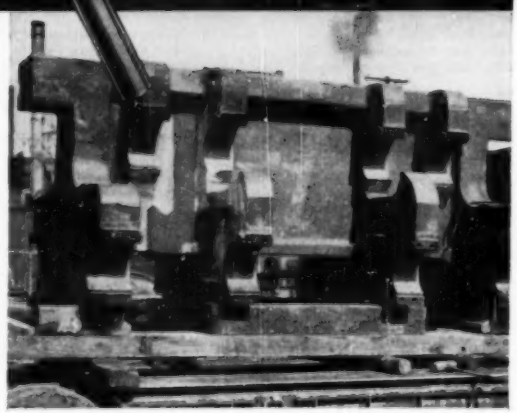
*Reg. U. S. Pat. Off.

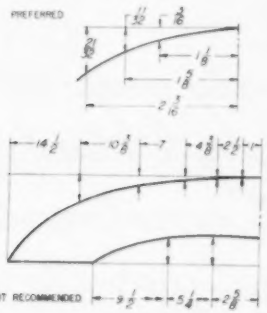


You can depend on ANACONDA®

BRONZE WELDING RODS

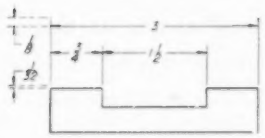
Rules for Dimensioning..II

pictured, double arrows extending beyond the centerline are used to indicate symmetry in combination with a note stating that the part is symmetrical about the centerline unless otherwise indicated.

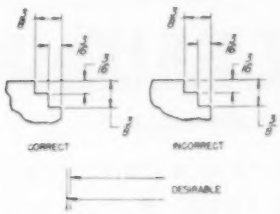


Where a number of ordinates and abscissa are used to dimension a curved outline or a series of holes it is desirable, in the interest of clarity, to extend each dimension line to the base line as marked "Preferred", rather than to use methods such as those shown below, which may result in confusion due to lack of general understanding of their meaning.

WITNESS LINES

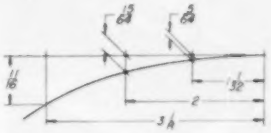


Witness lines begin 1/32 in. from the outline of the part and extend not more than ⅛ in. beyond the farthest dimension line.



Crossing of witness lines is usually avoided. When crossing is necessary, the witness lines are not broken at the point of crossing as shown at right.

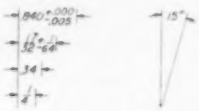
An exception is shown below. Witness lines may be broken when necessary to clarify the extent of dimension lines.



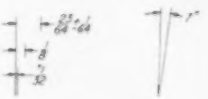
Oblique witness lines may be used when this is advantageous to avoid crowding or to improve the appearance of the drawing. On oblique witness lines a dot is used at points of intersection.

ARRANGEMENT OF DIMENSIONS

Dimensions are preferably placed midway between arrowheads, except in special cases described below.



Where the nature or magnitude of the dimension makes it impractical to show dimensions in the manner above, it is permissible to place the dimension between the witness lines with the dimension lines and arrowheads outside of the witness lines.

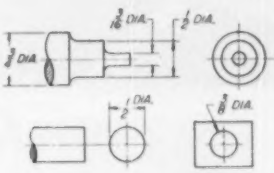


Where it is impractical to use either of the arrangements shown above, the dimension, its dimension lines and arrowheads may be placed outside of the witness lines.

OUT-OF-SCALE DIMENSIONS

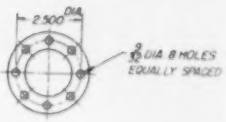
Original detail drawings are never issued with dimensions out-of-scale to any appreciable extent. Where changes make it impractical to show the new dimension to scale, the dimension must be underlined with a wavy line. "N.T.S." is never used to indicate out-of-scale dimensions.

DIAMETERS

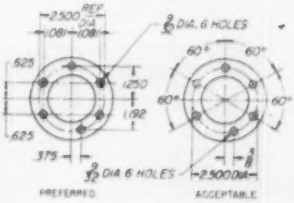


Dimensions indicating the diameter of circles are followed by the abbreviation "DIA."

HOLES ON A BOLT CIRCLE

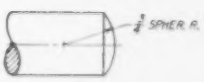


Holes which are equally spaced around a bolt circle are dimensioned by a note and a bolt-circle diameter as shown.

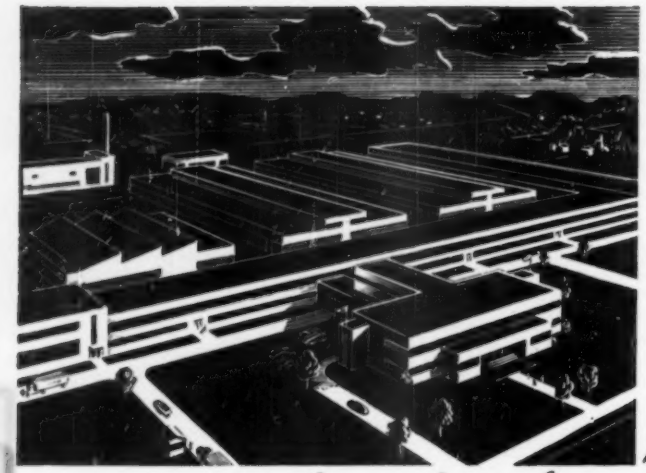


Where the spacing of holes around a bolt circle is other than equal, it is preferable to locate the holes either by ordinates and abscissa or angularly, rather than by descriptive notes which may tend to confuse.

SPHERICAL RADIUS



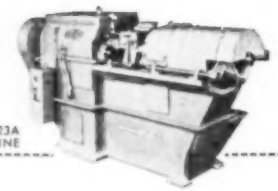
Whenever a portion of a sphere is dimensioned by a radius the dimension is followed by the term "SPHER. R."



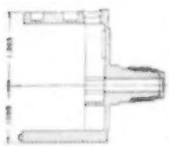
Keenly competitive modern plants have set a single standard for machine tool investments— cost-per-piece— plus sustained machine efficiency.

The reason for insistence on this scientific approach is obvious: the *right* machine pays for itself and begins producing sustained profit in a matter of months, weeks, even days.

New Britain Automatics are designed and built with *sustained low cost-per-piece* as the first consideration.



NEW BRITAIN MODEL 23A AUTOMATIC CHUCKING MACHINE



A New Britain Model 23-A four spindle tool rotating chucking machine turns out the part sketched, which is made from zinc alloy SAE Specification 903. Ten operations are performed, including turning, facing, chamfering, grooving and threading. In turning the outside diameter for threading, concentricity with the previously finished inside diameter is assured by the use of a pilot tool. 742 pieces are completed hourly — one every 4.8 seconds.

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

650HF1

MULTIPLE SPINDLE AUTOMATIC SCREW AND CHUCKING MACHINES • SINGLE AND DOUBLE END PRECISION STRAIGHT AND CONTOUR BORING MACHINES • LUCAS PRECISION HORIZONTAL BORING, DRILLING AND MILLING MACHINES

CHAIN-REAMING SETUP FED BY GRAVITY

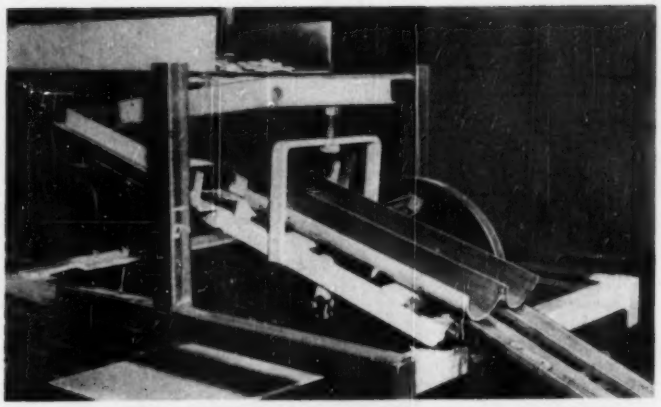
BY CLYDE JENSCH, Supt.
Railway Equipment Div.
NORDBERG MFG. CO.

SAE-8630 chain links for railway ballast-cribbing equipment are blanked and punched to shape in a punch press, but for accurate assembly the holes must be reamed. To allow the operator to pay scant attention to the reaming cycle—except for loading new links and removing finished ones—feeding and operating were made automatic.

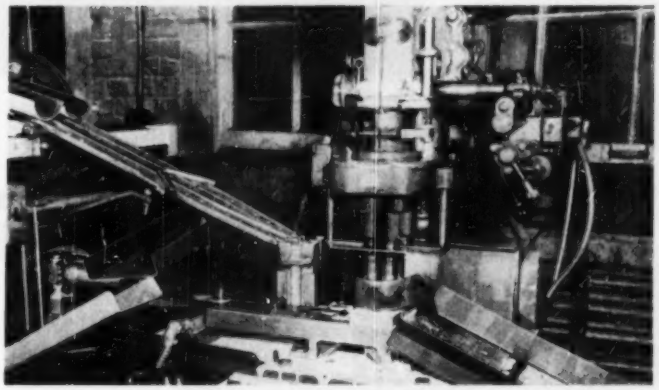
A standard Delta drillpress was equipped with a standard Bellows air cylinder to move the four-spindle drillhead. The feed stroke that shifted links in pairs down from the top pan, through twin chutes, into the vertical magazine feed, through the reaming jig, and out to a tote pan was worked around other standard air cylinders, precision switches, and solenoids.

Under the magazine a feed plate works to slip two links at a time into the jig. A double-acting cylinder, controlled by solenoid valves, powers the feed plate. When the reaming is finished, the drillhead raises, trips a switch, and starts the feed stroke over again.

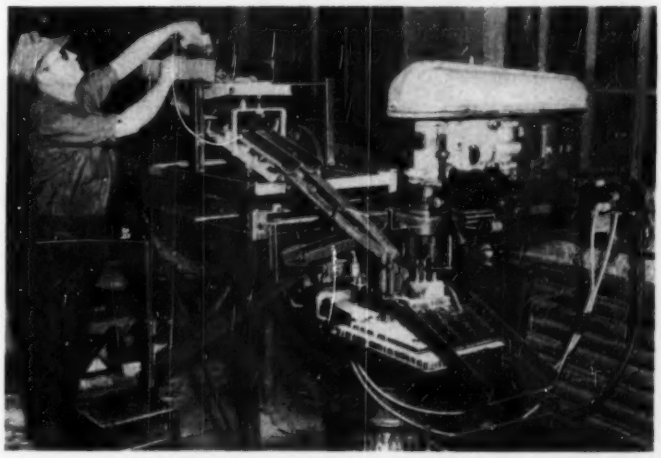
Reamed holes in the 2⅜x15/16x ⅛-in. links are held to plus-or-minus 0.0005 in. on a nominal ⅜-in. size. Reamers average about 20,000 pieces before regrinding is required.



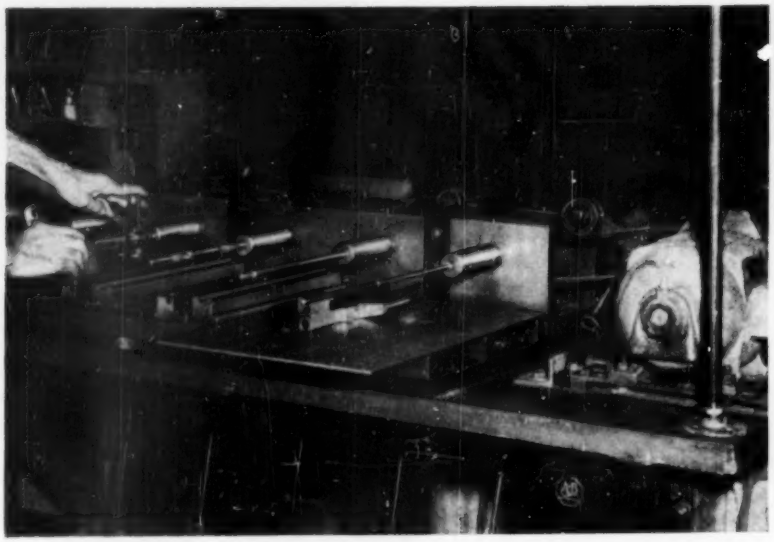
Top tray, bumped 56 times a minute by 1/6-hp geared-head motor through a V-belt and cam, drops chain-link blanks onto . . .



Twin chutes that lead to drillpress. Scraper bars on chutes divert extra links to prevent double-feeding. Links fall in . . .



Double magazine that works on air-cylinder power to feed them under four-spindle reaming head, which finishes 800 links per hour

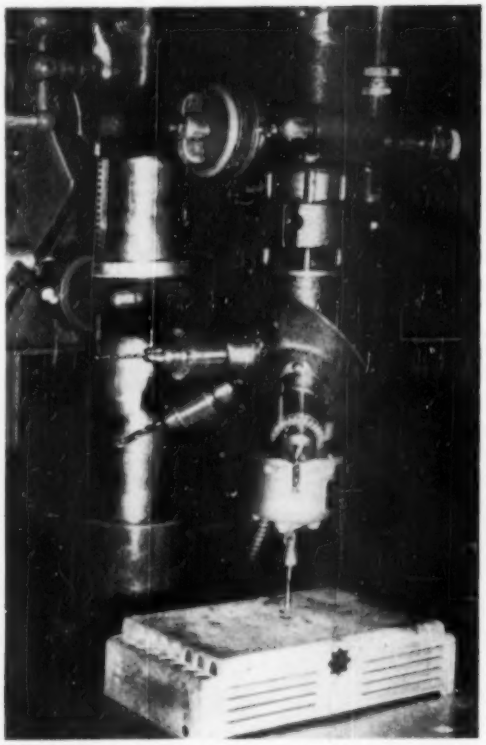


Homemade horizontal-spindle machine works three reamers, an end mill, and a countersink through V-belt drive off a small motor. V-pulleys on spindles behind plates are engaged separately by pedal-operated clutches that depress rider wheels

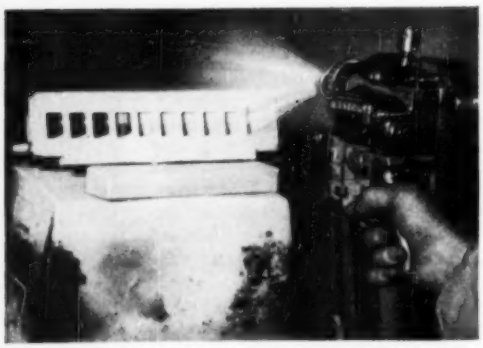
SHOP SHOTS

at

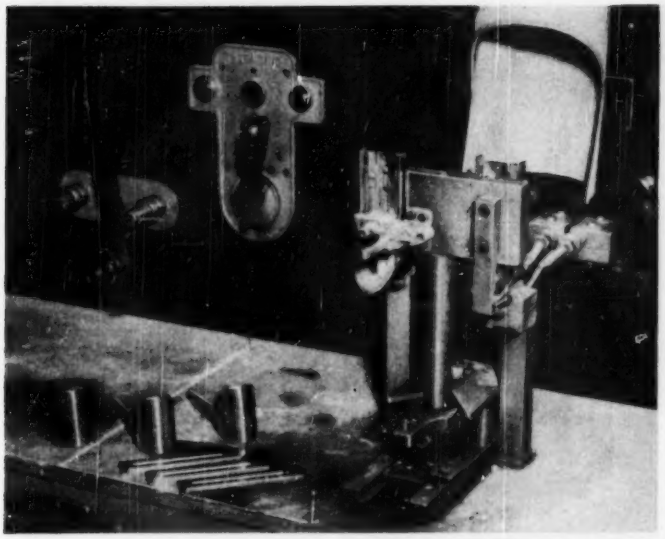
DICTAPHONE



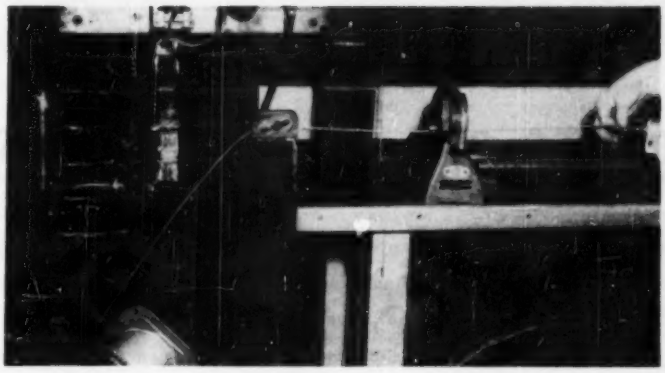
Quick-shifting multiple-spindle turret locates drill, tap, reamer, and countersink in rotation for fast operations on the same part. Quadrill unit carries four spindles; Lignomatic unit has six in the same head



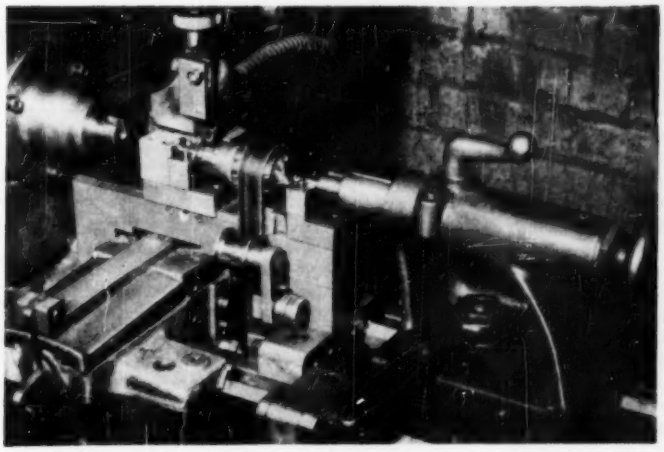
Metalsprayed shield over plastic machine cover stops spark emissions which make radio interference. Cover is first sandblasted, then sprayed with zinc or aluminum by portable gun



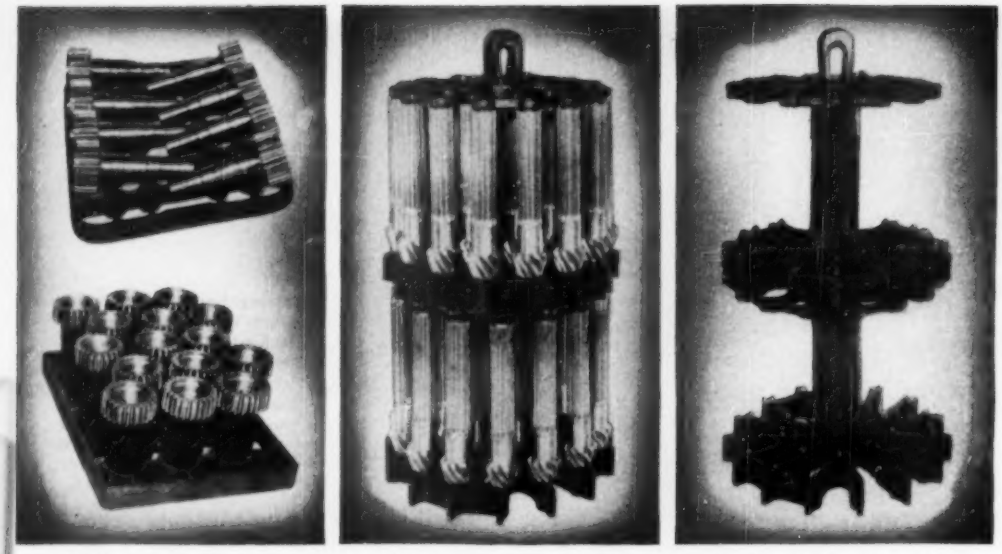
Swiveling braze fixture holds one set of parts for silver soldering by induction heat while second set is loaded under exposed toggle clamp. Fixture is reversed 180° and is pushed in on slide before automatic heating cycle is started by pushbutton



Solenoid cable cutter clips long lengths in small quantities. Cable is pulled through guide ring and shear to adjustable stop on pipe where switch is depressed to operate shear



Belt from separate, lever-rocked motor rotates recorder armatures at 5600 rpm for turning by vertically mounted carbide tool. Ground shaft journals are set in half bearings, and spring-loaded balls hold the shaft longitudinally. Lathe spindle does no work. Belt is tightened and motor is started by shifting and locking lever. Lathe leadscrew, also operated from separate motor, feeds toolslide above armature



Proper loading of carburizer trays and fixtures is extremely important to sound operation. Heat-treating costs for the input shafts loaded vertically would be slightly less than half those for horizontally ones. Also, the latter would not quench uniformly with the teeth resting on a hot tray. This is just one of many phases in which methods analysis can avoid wasting dollars. And proper fixtures effectively increase furnace output

HOW TO CUT HEAT-TREAT COSTS

Overhead to production labor ratios are seldom as high in any plant department as in heat-treating. This need not be. Analysis of general heat-treating practices, careful equipment selection, scientific shop layout, sound metallurgical control, and planned preventive maintenance can save you money. . . . *Here is how it is done . . .*

BY ROY F. KERN, Metallurgist, ALLIS-CHALMERS MFG. CO., SPRINGFIELD, ILL.

CURRENT economic trends dictate that cost levels of many manufactured products may only be maintained by increasing the quantity of finished material per manhour, at no sacrifice in quality. This cannot be obtained by physical effort alone. Management is obliged to study imporved methods and modern equipment; must stress the necessity of a constant vigil over operating costs.

Generally speaking, high overhead and production inefficiencies in heat-treating departments make them fertile territory for cost reduction.

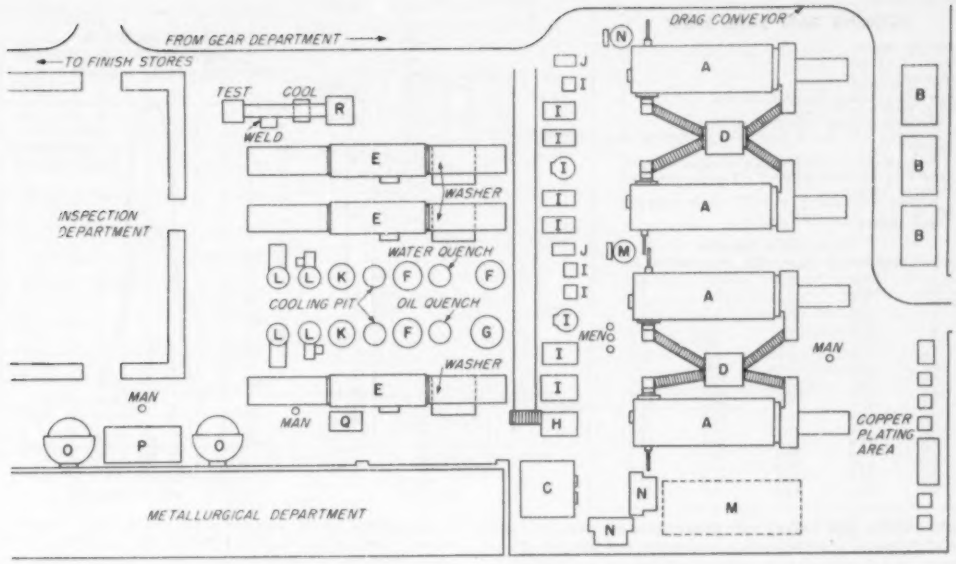
Postwar expansion at the Springfield Works of Allis-Chalmers called for machining and heat-treating crawler-tractor and motor-grader gears. Here was a much-desired opportunity to plan and install an efficient gear heat-treating department.

After five years, it is interesting to review the planning and operating policies that have contributed so much to making the program a success.

Where Do We Start?

Getting the plan rolling on the right track is immensely important. In a broad sense, a series of separate studies were necessary to install an efficient department. Logically, the first job was an analysis of general heat-treating and related machining practices.

Although gears had never been made at this plant, a comprehensive program of gear testing had been conducted for many years with both the dynamometer and field methods. Careful review of test results indicated clearly the properties required



HEAT-TREAT DEPARTMENT LAYOUT

A—Surface Combustion Radiant tube-fired tray pusher carburizing furnace. These 2-row tray pusher furnaces have 3 heating zones; the first 2 maintained at 1700 F and the last at 1550 or 1000 F, depending on whether the gears are to be quenched directly. Gears may be tray quenched with the lowerator-elevator mechanism or individually removed from the trays for press or conventional quenching.

B—Surface Combustion RX atmosphere generators; capacity 3600 cfh ea. These units supply RX gas for the carburizers (A) and hardening furnace C

C—Surface Combustion rotary-hearth radiant tube-fired hardening furnace used for reheating prior to quenching gears slow-cooled from the carburizing furnaces

D—Surface Combustion Standard-Rated large oven furnaces, equipped with doors at both ends and alloy roller rails as well as pneumatic charge tables, and used to burn off the oil and soot from the carburizing trays and fixtures after oil quenching

E—Surface Combustion Flight-Type conveyor air draw furnaces for drawing carburized gears after hardening; equipped with washers for removing the quenching oil from the gears

F—Hevi-Duty Carburizer—This design of furnace is particularly suited for case hardening stem pinions and shafts as parts can be suspended vertically to reduce distortion in hardening.

G—Leeds and Northrup Carburizer—For the same purpose as "F". Provides a check on the relative merit of two sources.

H—Hannifin Centrifugal Quenching Press for quenching large ring gears

I—Gleason Quenching Press for die quenching gears

J—Dennison Hydraulic Arbor Press for pressing quenching plugs from hardened gears

K—Leeds and Northrup Homo-Draw pit furnace for specialized tempering

L—Lindberg Cyclone pit draw furnace for same use as "K".

M—Bell and Gossett Quench Oil Conditioning System consisting of heat exchangers, strainers, and temperature control

N—Propeller Agitated Quenching Tank designed by Allis-Chalmers for this application

O—W. W. Sly table style blast cleaning machine used to clean all heat-treated parts prior to inspection for any defects

P—American Wheelabrator "Wheelapeening" machine for cleaning and shot-peening stem pinions and shafts prior to inspection

Q—Hannifin 150 - ton Hydraulic Straightening Press for hot straightening case hardened stem pinions and shafts

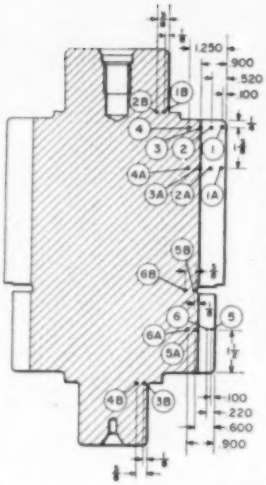
for maximum operational life. These tests, however, did not indicate a measurable preference as to how these properties were obtained, even though made with many different steels, heat-treated by numerous methods. All gave similar life when the end metallurgical and residual-stress condition met certain established limits. Hence the determination of general practices was considerably more simple, the only remaining problem being to determine an efficient method of arriving at suitable end conditions.

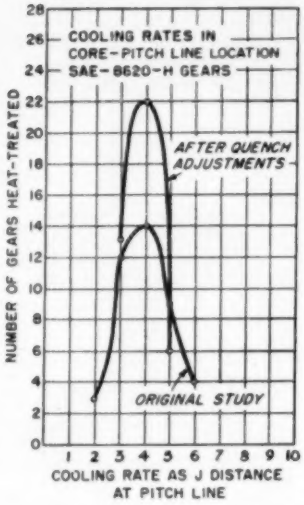
1—All gear forgings are made of regular-quality open-hearth steels, using the SAE-8600-H series wherever possible. For light fine-pitch gears, SAE-8620-H is used, while for coarse-pitch heavy final-drive gears, SAE-8627-H. Preference for this series of steels, in addition to the desirable combination of physical properties, is based on low cost and adaptability to the heat-treating process.

COOLING RATE DATA SHEET

Part No. 061452
Date — 5/12/48
Heat Treatment
Part Name Pinion, Second Reduction
By J. Reed & C. Cochanour
Normalized from 1750°F after forging.
Carburized in No. 2 continuous carburizer at 1700°F.
Furnace cooled to 1500°F then quenched on elevator into maximum agitated 120°F oil cycle complete, 15 hours.
Washed then drawn at 350°F cycle complete, 2½ hr.
Shot blasted.

	Cooling rate as J distance			
Point	Heat 656529	Heat 61769	Heat 162270	Av.
1	4.5	4.5	4.5	4.5
2	5.5	5.5	6.5	5.8
3	9.5	10.0	9.5	9.6
4	10.5	11.0	10.0	10.5
5	6.5	5.5	6.5	6.1
6	8.5	8.5	9.0	8.0
1A	6.0	5.0	5.5	5.5
2A	8.0	7.5	8.0	7.0
3A	12.0	11.0	11.5	11.5
4A	13.0	12.5	13.0	12.8
5A	11.0	9.5	10.5	10.3
6A	13.0	12.0	13.0	12.6
1B	14.0	13.0	13.5	13.5
2B	16.0	15.0	15.0	15.3
3B	12.0	13.0	13.0	12.6
4B	14.0	13.0	13.5	13.5
5B	14.0	13.5	14.0	13.8
6B	16.0	15.0	15.0	15.3





Hardenability and cooling rate analyses, made possible by use of H-steels, provide an accurate picture of method efficiency. **Heats of steel not up to specifications are quickly** detected and corrected. Point selection on the H-steel hardenability bands was made by preparing a frequency curve; plotting the cooling rates at the pitch line in the gear core against the number of gears at that cooling rate. Such practices need not be confined to large companies

2—Machining practice on spur gears is to rough and finish-hob (or shave) from a finish-broached bore.

3—Steps on the sides of gears to be die quenched are held to 0.001-in. tolerance for quench die fit, which in some cases entails grinding.

4—The gas carburize and direct-quench procedure is employed nearly exclusively; thus no machining is done between the carburizing and hardening operations, even though this requires copper plating on some parts.

5—Small gears are quenched on splined plugs by locating on the major or root diameter of the bores, which are broached to 0.001-in. tolerance.

6—All gears are divided into two furnace groups. The first group, consisting of more-or-less flat gears, is scheduled through continuous gas carburizers. The second group, run in pit-type carburizers, consists of long gear shafts and stem pinions, which are suspended vertically to reduce distortion. These carburizers also provide a desirable flexibility of equipment in the department.

7—All quench tanks are equipped with variable-speed propeller agitators to insure that no steel is slack quenched. Some tanks can develop a Grossman H valve of 0.6.

8—Quenching oil is straight mineral with a 100 SUS at 100 F viscosity. It is maintained at a temperature of 110-120 F and is constantly recirculated through screen filters.

Some of these practices might seem to indicate a disregard for factory cost (particularly in machining), but it was found more efficient to machine a gear to the tolerances necessary for trouble-free heat-treating. Delay in heat-treating costs more than twice as much as similar delay in the machine shops.

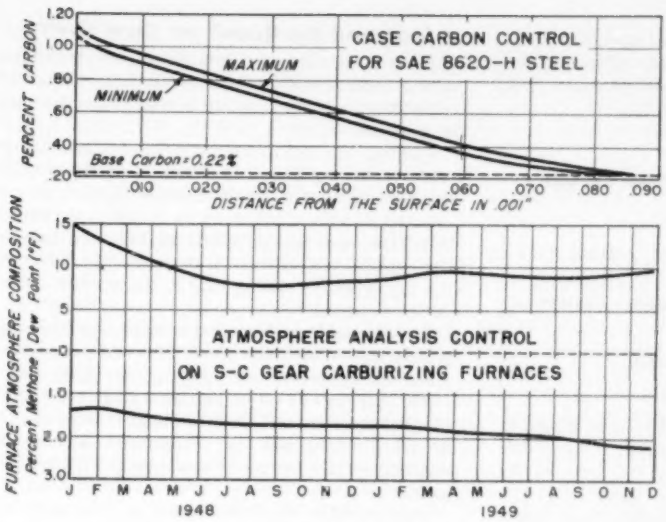
Selection of Equipment

A close second in importance to the development of general machining and heat-treating practices, equipment was chosen with the following factors in mind: It must be capable of producing parts of the prescribed quality, dependable and easy to maintain, of sound design and made of the highest quality materials. Also, it must be safe for an employee to operate with a minimum amount of effort, must operate without creating undesirable working conditions, and must accomplish all of the foregoing at lowest possible operating costs.

To determine the quantity of heat-treating equipment required, all gear drawings were studied to: A—Schedule each part into either continuous or pit-type carburizing furnaces. B—Determine the most efficient loading in accordance with normal furnace design and uniform heating and quenching. C—Calculate carburizing cycles for the specific case depths.

Point B cannot be overstressed because it is this study that largely determines heat-treating cost. No plan floor space is so valuable as the inside of a heat-treating furnace, and to achieve low factory costs it must be kept occupied. A furnace operated at only half its rated capacity is no less ridiculous than a 10-ton truck hauling 5-ton cargos. Here furnace-alloy manufacturers are of considerable help, for by proper fixturing, lower costs and higher quality result from uniformity in heating and quenching.

With the prime importance of proper fixture design accepted, the policy on this equipment is



Furnace control, based on daily gas analyses for furnaces and atmosphere generators, plus case-depth and carbon-concentration measurements, pays off. The narrow bands of variation over two years speak highly for modern control equipment; reflect untold savings in scrap and salvage

essentially: 1—Let the suppliers design the fixtures in accordance with good foundry or fabricating practice. 2—Purchase fixtures on performance (cost per hour life at heat or per quench) and not merely on cost per pound. 3—Keep fixture sections light for efficient heating, quenching, and initial cost. Designs are often very inefficient in the work-to-alloy weight ratio, preferably maintained at a minimum of about 3 to 1. And 4—Maintain heat-treating-alloy life records.

Furnaces are frequently overloaded, not necessarily for production efficiency, but as a result of improper load calculations either at original installation or as production schedules increase. Heat-treating equipment operates at destructive temperatures, and load studies should include a delay factor for late material deliveries and both regular and preventive maintenance. We found delay and maintenance factor of 15% most suitable.

Department Layout

Layout is obviously important. Not only is floor space extremely valuable, but the correct positioning of equipment provides to some degree for higher quality. This is largely a result of the reduced hazard of missed operations and reduced damage in han-

Quenching presses are located at the discharge end of the continuous carburizers. This provides minimum handling distance for hot parts. Large open area allows free movement for hot, heavy, and bulky loads. Oil absorbent is spread on the floor to prevent workers from slipping, and retard fire, because of oil splashed from presses

dling. Proper layout with consequent smooth department operation also has a desirable effect on the morale of employees as efficiency promotes job pride.

FIVE PRINCIPLES FOR PLANNING LAYOUT

1. **Efficient use of floor space.**
2. **Direct flow of material.**
3. **Efficient use of manpower.**
4. **Maintenance of best possible working conditions.**
5. **Provision for future expansion.**

Direct flow of material is usually quite simple to provide, but efficient use of manpower is more difficult, principally as a result of the long cycles necessary on some heat-treating operations. The general rule in this respect is to double up on duties until a man is occupied at all times, as shown in the department layout.

The extreme importance of minimizing operator fatigue must be recognized and every effort made in that direction to maintain a suitable level of productivity. By use of power hoists, roller conveyors, and other handling equipment, physical effort required is not excessive. Working conditions are also notably benefited by numerous ventilating and exhaust systems.

Space for five additional continuous carburizers was provided parallel to the upper carburizing furnace. This is the case also for quenching presses and gear draw furnaces. Other equipment may be supplemented to a large extent in one direction or another without creating congestion.

Controlling the Department

Even with proper layout, machining, and heat-treating practice, certain factors within an efficient heat-treating department must be closely controlled, to insure a uniformly high quality product at suitable cost.

These are: 1—Heat-treat Operations, 2—Dimensional Quality, 3—Carburizing Quality, 4—Quenching Practice, and 5—Fuel Utilization.

Control of heat-treating operations includes the specification of furnace temperatures, loading schedules, furnace cycles, carburizing and quenching tooling to be used, plus the standard times for each operation. To accomplish this, Heat-Treat Operation Sheets are prepared for each part.

Control of dimensional quality is assured by the immediate and constant "spot" inspection of the gears at the quenching presses as they are hardened. In addition, gears from new heats are run through the Department in pilot quantities so that machining adjustments may be made, if necessary, when the production lot in that heat of steel is scheduled to be machined.

H-Steels and End-Quench for Close Control

From a metallurgical standpoint, the most fascinating control work is that conducted on the gear quenching, for here is an often sadly neglected phase of gear heat-treating.

Cooling rate studies are made for each gear design. After sectioning a gear that has received the specified heat-treatment, hardnesses are checked at preselected significant locations, as shown in the sketch. With the end-quench hardenability available for the applied heat of steel, it is possible to determine the approximate cooling rate in the quench at each of these points.

Selection of H-steels based on hardenability bands is described in *SAE Handbook 1948 and in American Machinist Reference Book Sheets Nov. 6, 20, Dec. 4, 1947.* This method offers two advantages: Certainty of what the steel will do when heat-treated, instead of mere description by composition limits, and economy — the cheapest steel that will function properly.

Hardenability bands are based on the Jominy and Boeghold end-quench test. These bands (area between maximum and minimum hardness curves) reproduced, indicate the spread in hardness that may be obtained at any depth in the corresponding H-steel. Jominy (J) distance is used to measure the significant locations, and is simply the distance from the end of the bar to the point of test in 1/16-in. increments. There is a direct relationship between

ALLIS CHALMERS MFG. CO. SPRINGFIELD WORKS

HEAT TREAT OPERATION SHEET

NO OF SHEETS 1 of 2 — WEIGHT OF PART 12.6 LBS

ISSUED BY DCH

ARTICLE	MATERIAL AND CONDITION	USAGE
Gear, Reverse	ACB - 5/8 Steel Forging Machined To Operation 9	HD-19 1/tractor

OPER NO.	OPERATION	FURNACE	TIME PER PIECE
9	CARBURIZE 26 Per Hour	B-2909	.036
	TEMPERATURE ZONE 1 - 1700 ° F		
	ZONE 2 - 1700 ° F		
	ZONE 3 - 1500 ° F		
	GAS ANALYSIS O_2 - 0.0 %		
	CO_2 - 0.0 %		
	CO - 19.5 - 21.5 %		
	CH_4 - 1.25 - 2.25 %		
	H_2 - 38.0 - 41.0 %		
	DEW POINT + 15° F. MAX.		
	LOAD THIS PART ON A 16" X 22" TRAY		
	ALONG WITH OTHER PIECES SO THE NET		
	WEIGHT PER TRAY WILL BE 175 LBS.		
	PUSH CYCLE 1 HR. 0.0 MIN. TOTAL CYCLE		
	15 HOURS. CASE DEPTH SPECIFICATION		
	.050" - .060"		
	SEE PILOT LOT SHEET FOR QUENCH DATA		

APPROVED - H.T. DEPT. ALH — DRAWING NO. 050051

APPROVED - MET. DEPT. RFK — DATE 1-3-50 — ISSUE NO. 10

Heat-treat Operation Sheet should be prepared for each part-design. Information provided must be at least as complete as that for efficient machining procedure. Standard information may be pre-printed on the sheet to save time in preparation

this distance, the as-quenched hardness, and the cooling rate for each H-steel.

The determination of cooling rates, rechecked for nearly every new heat of steel, is useful because it:

1. indicates the severity and uniformity of quenching.

2. indicates the correctness of steel selection for the sections involved and the type of quench employed.

3. allows intelligent assignment of heats of steel to certain part numbers for an improvement in quality or uniformity.

4. permits original, scientific determination of the points on the hardenability bands of the "H" steels which are purchased, plus a constant recheck of the choice of these points.

Hardenability band points specified for H Steels are those at which the crest of the foregoing frequency curve exists. To provide for still greater uniformity the cooling rate in quenching is reduced on those gears showing excessive core hardnesses and increased on those showing low core hardnesses.

Steels in a few gears were sometimes found to be far enough off in hardenability level to warrant a steel change to obtain maximum metallurgical quality. The controlled severity that is possible with modern quenching equipment provides for very close reproducibility of these cooling rates, the end result of which is greater uniformity from gear to gear and from one heat of steel to the next. This control of quenching also permits the use of lower-priced steel such as SAE-8620-H over a wider range of sizes and designs than is possible with unknown and/or uncontrollable quenching.

Case-depth and carbon-concentration control is maintained by microscopic and step tests as well as daily gas analysis on each furnace and on the atmosphere generators. The uniformity and quality of work possible from modern gas-carburizing equipment is shown by the graphs of atmosphere analysis and case-carbon control for 1948 and 1949.

As in the control of quenching practice, an often-neglected phase of efficient heat-treating department operation is fuel or combustion control. Through constant checking of flue-gas analyses, high combustion efficiency is maintained, which keeps fuel costs to a minimum.

Maintenance Program

In normal operation of the equipment in gear heat-treating departments, each furnace usually contains several thousand dollars worth of semi-finished gears. Failure of these furnaces to operate properly would be costly. This possibility of failure in operation does not necessarily indicate faulty design, but is ever-present because this equipment is operated at destructive temperatures. Accordingly, it is most advantageous to set up a maintenance program consisting of:

1 — Scheduled shutdowns for internal inspection and replacement of parts before complete failure. 2 — Regular carbon deposit burn-out operations to preserve heat-resistant alloy furnace parts and provide for closer atmosphere control. 3 — Stocking a full set of spare parts, as recommended by the manufacturer. This is important because some furnaces are of special design and spare parts are not always available on short notice in the event of a breakdown.

With this maintenance program, not a single gear has been lost, nor required salvaging, because of failure of furnace equipment.

Gear Quality Obtained

To evaluate properly the quality level of the gears produced at the Springfield Works the diversity of the types and sizes of gears which are heat-treated should be considered. Types of gears include spur, helical, worm, and bevel. Sizes range from 3.0 in. to 20.4 in. PD, face width from 0.650 to 5.625 in. and weight from 0.75 to 285 lb. Even with this multiplicity of design and mass, only three gear steels are used: SAE-4815-H (very limited usage), SAE-8620-H, and SAE-8627-H. Dimensional and metallurgical results obtained are briefly:

Case Hardness—60 to 63 R_c Mill file-hard

Core Hardness—26 to 48 R_c at pitch lines of all gears and for all steels. For any one steel the core hardness range is that of the hardenability band.

Pitch-line Runout—0.0003 in. max per in. dia.

Pitch-diameter Size Tolerance—0.0002 in. max per in. dia.

Side Runout—0.0002 in. max per in. dia.

Flatness (Bevel Gears)—0.0015 in. max out of flat on back face.

Spacing Error—Five pitch and finer—0.00075 in. max.—Coarser than five pitch 0.0015 in. max.

Tooth Taper—0.0005 in. max per in. face width.

Bore Taper (P.L. of Spline)—0.0003 in. max per in. width.

Most heat-treating trouble was anticipated on a large (285-lb) final drive gear in controlling its distortion in heat-treating. Actually this gear, which is believed the largest case-hardened automotive gear made today, is one of the best gears both dimensionally and metallurgically. Apparently its indifference to dimensional changes in heat-treating is a function of its great mass.

Tips FOR TOP SHOP MEN

349 Time—long a measure of manual accomplishment—is likewise a gage of management effectiveness. Results come faster when top men are in command.

350 There are those who resent "methods improvement"—as a fetish, nuisance, or bother. You may overcome their resentment by pointing out that plain English for the process is common sense, systematically applied.

351 Some executives cannot improve without criticizing; some shop men cannot receive an explanation or a change without feeling criticized. One is as useless as the other in a progressive plant.

ROUND TABLE

Fire or Fizzle?

Al lounged into Ed's office just after quitting time one night, stopped short, and then made a mock run out the door again.

"What's this—frothing at the mouth again?"

"Oh, it's you! Yeah, I'm burned up; and this time I have plenty of reason, too." It's this blasted personnel-department 'separation interview' they started up the other day. I swear those guys lie awake nights thinking up dodges to give me trouble!"

"Oh, yeah; I remember reading a memo about it—but I haven't heard how the thing works yet."

"Oh brother, it works fine! I canned Potts yesterday for insubordination and general inefficiency, and just this morning I saw him working over in Ben's assembly section. What I want to know is how can I hold any authority around here if I can't fire a bum worker?"

"Now wait a minute, Ed, you did fire him. So what if Personnel did get him a job somewhere else in the plant? You got rid of him—there's nothing wrong with your authority there. Personnel is supposed to try to place workers where they will fit. Somebody probably figured Potts would keep his nose clean in Ben's section."

"Nuts! The guy's no good, and he won't work anywhere. Another thing I resent is the fact that Personnel completely disregarded the evaluation statement I sent them—and that's their own idea, too!"

"Well, I know you're supposed to evaluate the worker when you get rid of him, but that doesn't mean that he might not do a good job in another place. All you can judge is what he does here in your own department."

"Look, I can also judge what kind of a guy he is, too. My opinion should be worth more than somebody's in Personnel. I've seen Potts every day, and Personnel hasn't seen him since the day he was first hired."

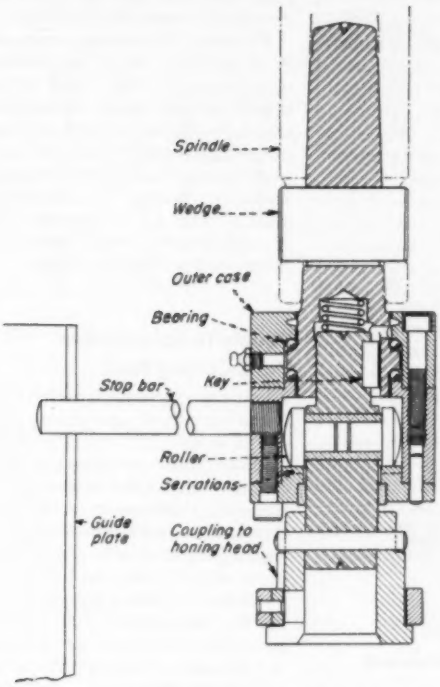
"Sure, but they ought to have a chance to place him again. Don't forget, good workers aren't too easy to find nowadays."

"Who's a good worker—Potts? He's a clinker as far as I'm concerned, and I'm going to tell Ben about it!"

"And spoil his chances over there? That's not not giving the guy an even break, Ed."

CAN "EVALUATION INTERVIEWS" *save good workers for other departments, or is a man finished in one company as soon as he gets mixed up in one department? How about Ed's idea to tip off Ben about Potts? Discussions of earlier topics appear on later pages in this issue.*

Practical Ideas



Honing Attachment Works On Vertical-Spindle Mill

BY GIVING an oscillating axial motion to a conventional honing head, we have done a super-finishing job on cylinder bores with a simple attachment.

The tapered shank of the attachment is fitted to the machine spindle by a drift. The shank of the attachment supports an outer case by means of two rows of ball bearings. This outer case is prevented from rotating as the machine spindle revolves because of a stop bar which rides vertically to a slot in a guide plate that is fastened to the machine. A bored plate fastened to the bottom of the outer case is serrated so two rollers in a stub shaft that runs through the plate will bounce up and down as the stub shaft revolves. The rollers are held down against the serrations by a compression spring in the shank of the attachment.

As the coupling to the honing head is rotated by the machine spindle, fast up and down motion of the head makes the honing stones follow a complex oscillating path. The result is a good super-finishing motion. *Nobuo Arakawa, Tokyo, Japan.*

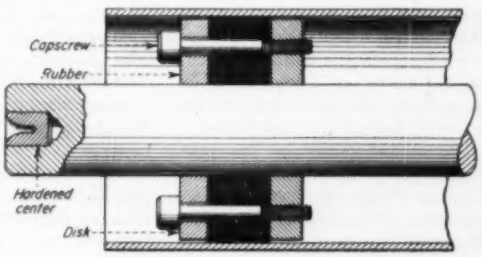
Die-Rubber Disks Chuck Long Tubes Internally

WHEN WE HAD to face the ends of 4-in., stainless-steel tubes that were 24 in. long to a length tolerance of ±0.002 in. and a parallelism of ±0.0002 in., we ran into the problem of holding them without distorting them. The tubes were not true in roundness of ID or OD and some were not even straight.

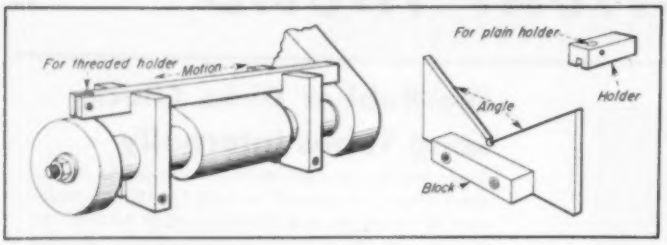
This mandrel, which had two disks of die rubber that gripped the tubes, did the job neatly. There was no chatter because of the resilience of the rubber, and there was no slippage although care had to be taken to keep oil off the tubing so that it would not run onto the rubber disks.

The rubber disks, under slight clamping pressure between the two steel plates, were first ground concentric and to a diameter that would allow them to just slide into the tubes. Four socket-head capscrews spaced equally around the disks squeezed the steel plates to expand the rubber after the tubes were in position. This held the tubes firmly and also allowed final adjustment because one or two of the capscrews could be tightened or loosened. The back end of the mandrel was supported by a conventional tailstock center.

Distortion of the work when it was held by this method was so slight that tubes were faced to a parallelism of ±0.0001 in. total indicator reading. When the tubes were removed from the setup and checked by an inspector, this parallelism reading did not change more than a tenth. *Robert Roedder, Berwyn, Pa.*



RODS OR BARS which are frozen into holes can be more easily removed with a lathe dog than with a conventional wrench or pipe wrench. A large dog can be attached, with the setscrew driven in tightly, to provide good leverage. Adding a wrench to the lathe dog, though, is not good sense because you will most often wind up with a broken dog and a scarred rod. *H. G. Frommer, Milwaukee, Wis.*



Two Grinding-Wheel Dressers Do Accurate Forming

THE ATTACHMENT at the left was made up when we had to dress the wheel on a lathe grinder for plunge-grinding a small broach. The wheel normally grooved after about four cuts on the land of the broach, which had four teeth.

Two plates were drilled and slotted to fit the grinder quill, and two notches were made to hold the horizontal bar with a sliding fit. The end of the bar was drilled and tapped for the threaded diamond holder, which was clamped in place by a capscrew through the end of the bar that was slotted.

By feeding the diamond the same amount each time it was advanced, we found that the problem of holding the size of the work was made easy. The thread cut in the bar and on the diamond holder was a ½-in.—20 thread, which fed the diamond tip 0.050 in. per revolution. Eighth-turns could be accurately made, so each time we turned the diamond holder, the diamond was advanced 0.0063 in.

The second gadget, on the right, is similar to one suggested by Thomas Pfeiffer in Practical Ideas recently (*AM*—May 15 '50, p125). We used this to dress a grinding wheel to a 90° angle, with sides 45° up from the horizontal.

The plate was made from ½-in. brass stock, supported by a steel block bolted in place. The angles of the cut were formed accurately with a ½-in.-radius relief at the vertex of the angle. The block was bolted in place.

The dresser holder was made from 1-in. cold-rolled steel, which was slotted to fit over the brass plate, and was drilled for the diamond holder and a setscrew. This holder did not have to be threaded. The gadget was utilized on a magnetic table—hence the brass stock so the holder would not stick to the plate. The brass plate had to be exactly aligned with the spindle that carried the wheel, and the plate had to be directly under the wheel for dressing. *Robert McCloud, San Lorenzo, Calif.*

Acid Mix Eats Out Broken Taps in Stainless

REMOVING TAPS AND DRILLS which have broken in holes in stainless steel is a formidable problem. When the tools are large, they can be drilled out with a smaller drill and chipped out of the hole. When they are small, it is often necessary to flow solder into the hole and to machine off the top surface. Neither method is always satisfactory.

A new method for loosening taps and drills—when they are broken in a stainless-steel part—is to fill the hole with an acid mixture which eats away the high-speed steel, but leaves the stainless unaffected. When the size and shape of the part permits, the part can be immersed in the liquid.

The mixture is one part each of hydrofluoric acid (technical grade, 48%), nitric acid (40° baume), and plain water. An eye dropper can be utilized to drip it into small holes. Probing the tool with a sharp instrument while the acid is working helps the eating action. Cold-water flushing of the part after the tool has been removed will wash the acid away.

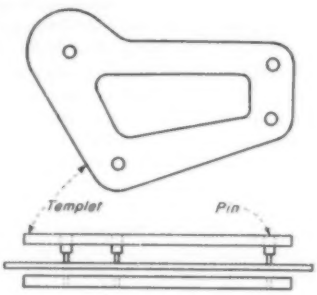
Warning: The acid is dangerous. Wash off with water immediately if it contacts skin, and avoid breathing the vapor. Magnesium hydroxide, chalk, or milk of magnesia rubbed well into the skin will serve as first aid after washing. Medical attention is necessary, even if first aid is applied. *Jay W. DeDapper, North American Aviation, Inc., Downey, Calif.*

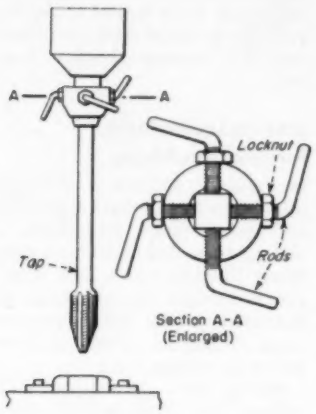
Double Templets Guide Hand Cutting Tools

WHEN THE QUANTITY does not justify the expense of a press tool, parts can be shaped to a templet by this method: Make two templets thick enough to give good support to the material, and harden them both. One templet is fixed with three or four hardened pins to slip through previously drilled holes in the material and the other templet.

With the rough blank inserted between the templets, the assembly is clamped in a vise and the material is formed to the templet shape by cutting it with a square-end shearing chisel. One templet may be cut slightly undersize, so the other templet is the only one that has to be followed when cutting.

Large jobs can be handled if they are clamped against a suitable support on a bench. If the edges of the templets are square, practically no trimming will be required. *R. H. Fry, Surrey, England.*





Spider Tapholder Allows Easy Resetting

WITH A non-reversing drillhead, tapping is conveniently done by chucking a long-shank tap and running through a number of parts in succession. The parts pile up on the shank until the tap is unchecked and they are removed.

We have an adapter which is held in the normal drill chuck, and which allows quick removal of parts. The tap is a HSS machine-nut tap with a long round shank and a squared section at the end for chucking. The adapter is a round drilled block with four threaded and bent rods screwed into radial holes. Three rods are held permanently after the tap has once been centered by locknuts. The fourth is the only one that has to be loosened to drop the tap out of the adapter. The other three do not fit too tightly.

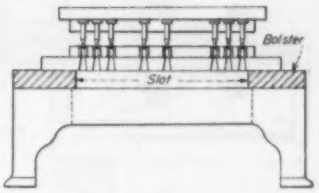
True running is assured by marking the tap and adapter so in each new assembly the tap will be in the same relative position—that is, each side of the squared shank will be contacted by the same threaded rod each time.

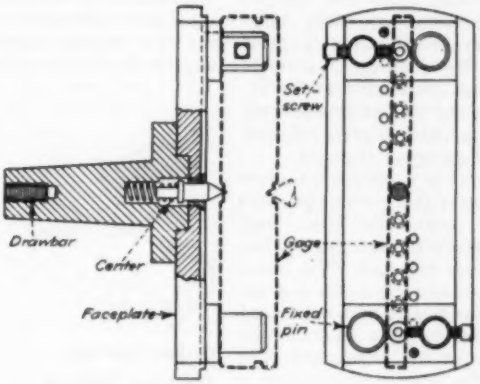
The threaded rods should be set in the form of a spider with their ends pointing away from the direction of rotation. This is to prevent their catching in the operator's sleeve. *Dan Penway, Carlisle, England.*

Slotted Bolster Plate Passes Scrap, Saves Punches

WHERE A VARIETY of long narrow stampings are pierced along the length of the parts, dies are often installed over grooves cut along the die shoe, or the dies are mounted on blocks. This allows cleaning out the scrap at intervals. Unfortunately, the operator often forgets to clean the scrap away, and broken punches are the result.

We have a bolster plate with a slot about 2 in. wide cut out with a torch. The slot is as long as the hole in the press bed, and all we have to do is mount the bolster, then the die. Scrap is dropped to the floor, and the operator does not have to think about it until the run is over or until quitting time. *F. C. Twist, Whitby, Ontario.*





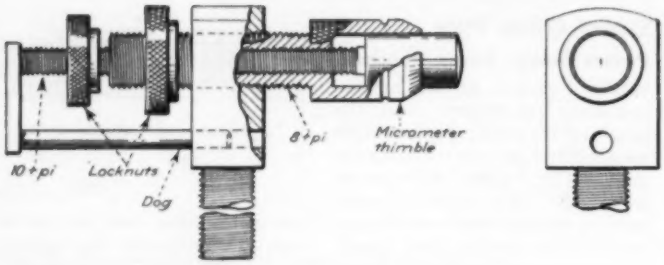
Lathe Fixture Recenters Automatically

TO CENTERDRILL, turn the groove, and turn the OD in plate plug gages, we formerly had to center the work on a jig-boring machine. With a fairly simple lathe fixture, mounted in the spindle nose, we can do the job just as accurately and much faster.

The shank of the fixture is fitted to the spindle nose, and is drilled and tapped so it can be operated by a drawbar. A faceplate is attached to the shank, and both are bored out for a spring-loaded center that works through a brass bushing in the plate. Once the faceplate is adjusted to run concentric with the spindle, and once the center is checked to make sure it is on the centerline, the job is simple.

Gages are located between two sets of round pins extending from the faceplate. One at each end has a setscrew which clamps the gage against the opposite pin. The larger pins are both located so the work will be clamped exactly on center. After the work is indicated to locate it vertically on the faceplate, it is centerdrilled. In this position, the work compresses the spring-loaded center in the faceplate.

The work is now reversed, and the centerdrilled hole is located over the spring-loaded center, which automatically positions it right. Then the turning and grooving work can be done. *C. Jaikens, Halifax, England.*



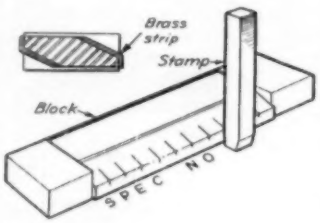
Adjustable Stop Increases Machine-Tool Precision

OLD MACHINE TOOLS that are not equipped with adjustable table stops can be improved a great deal by the addition of a shop-made stop. This one can be attached to any kind of base desired, and can be attached to the machine in any of a number of places.

The unit has a differential-screw arrangement that permits graduation in thousandths. The long, smaller screw through the unit has ten threads per inch. This screw cannot rotate because the dog attached to its left end has a rod which engages in a hole through the base of the attachment. The bore of the larger, shorter screw is cut to ten threads per inch, while its OD is turned down to 8 threads per inch—the same thread as the one inside the base of the unit. Two locknuts are provided to allow clamping both screws so no shifting will occur when the stop is in use.

The thimble attached to the right end of the larger screw is graduated in 25 equal divisions, which can be read opposite an index mark on the anvil of the smaller screw, which extends through the thimble. As the thimble is turned one small division, the large screw is rotated 1/25 of a revolution, moving it 1/200 of an inch. This rotation moves the smaller screw and anvil 1/25 of a revolution, but the thread there is ten per inch, so movement is 1/250 of an inch in the opposite direction, axially. The net result is to move the anvil 1/200 in. less 1/250 in., or 1/1000 in.

Because it is rugged and easily adjustable without a wrench of any kind, the unit is quite satisfactory. *H. R. Gilliam, Mancaster, O.*



Guide Locates Marking Stamps

BECAUSE OF a number of complaints from customers about the unevenness of our stamped serial numbers, we made up a stamp guide that would space out two sets of marking stamps.

First we machined a steel bar flat, then relieved it in the middle, leaving pads at each end. Two brass strips as long as the relieved sections of the guide were marked, each for a different set of stamps of different width. Then the two brass strips were soldered to the guide, one on the top, and the other on the bottom. What we had, in effect, was a marked guide that was double-sided.

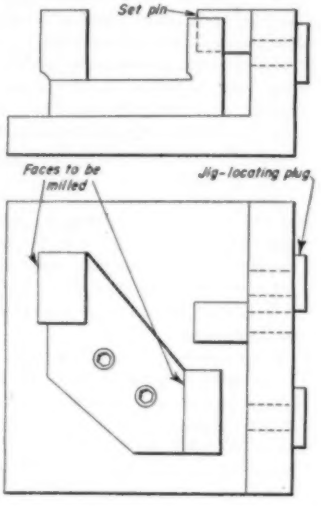
We magnetized the steel guide on an electromagnetic table so it would hold down on steel parts, and would even stay in place on a vertical steel surface. The brass stock was thick enough to prevent magnetizing the steel stamping dies when they were located along the guide so we could mark our products. *J. F. Kennedy, London, England.*

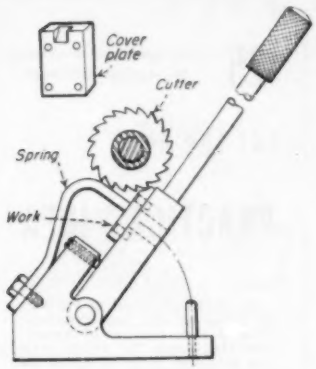
Set Pins Locate Cutter For Final Machining

IN A RECENT SECTION of Practical Ideas there is an article describing an indicator block for locating a milling table under the cutter by Frank Biechele (*AM*—Mar. 6 '50, p121). I would like to enlarge on the idea by saying that we produce parts in batches of 500 to 1,000 pieces by similar methods.

Setting faces are utilized on all milling and grinding fixtures of this type. Whenever possible, these faces are simple, hardened, round studs set into blind holes in some convenient part of the fixture, and ground off so they will be exactly ten thousandths behind the correct location of the grinding wheel or milling cutter for the final cut. By utilizing simple rods for this purpose we can easily replace them if they are accidentally damaged.

This arrangement also helps inspection to check the setup before production is started. Such fixtures can also be used for final-inspection purposes. *R. H. Fry, Surrey, England.*





Swinging-Arm Fixture Cuts Milling Costs

TO TURN OUT a small lot of cover plates that had to be slotted in one end, we rigged a swinging-arm fixture that located the work, held it down without clamps, and ejected it automatically.

A base was milled and slotted for a flat arm with a handle which would hold the work. Four pins were driven into holes in the arm to position the parts. A larger hole, drilled through the center of the area where the parts were held, was to clear a fixed pin on the base that would knock out the parts.

Through the base a tapped hole was machined to take a long setscrew. This was a permanent, adjustable upper-limit stop that prevented the work from being driven too far into the cutter as the arm was raised. A spring was bolted to the base to contact the work as it was lifted, thus holding it down on the arm. *S. A. McDonald, Ottawa, Ontario.*

TO FIND MAJOR DIAMETER and lead of small, deep, tapped holes when no taps or screws of the right thread are available, take a piece of soft solder and turn it into the hole. The tip end should be pointed so it will start, and a portion just behind the tip should be flattened so it will be larger than the OD of the thread. The thread will cut a form in the solder that can be checked for dimensions. *Allen L. Gee, Frankfort, Ky.*

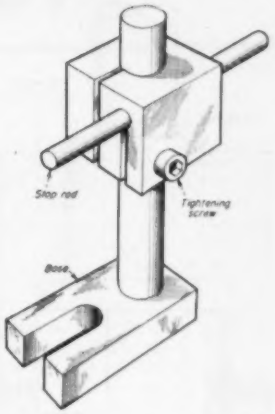
Table Stop Locates Work in Miller Vise

SHORT REPETITIVE MILLING or drilling work that is done with the parts clamped in a miller vise can be speeded if a table stop is added to the setup to locate the work for clamping.

The block is drilled to provide a 1-in. hole, a ½-in. hole, and a ⅜-in. hole that is tapped partly through from the back of the block. Saw cuts are made to intersect the 1-in. hole and the ½-in. hole. A ⅜-in. socket-head capscrew is assembled through the tapped hole to compress the block, which grips it on a 1-in. vertical rod and the ½-in. horizontal stop rod.

A standard C-clamp can be altered to provide a base which will fasten in a table slot.

A setup can be made with one hand to tighten the capscrew,



which locks both rods at once, while the other hand locates the stop rod. Work is slipped into the miller vise and located against the fixed jaw and the stop rod. *Robert Roedder, Berwyn, Pa.*

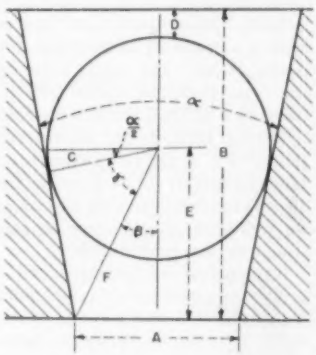
One-Ball Method Measures Tapered Holes

RECENTLY we had to measure a set of tapered holes in some home-made gages, but when we tried the two-ball method we were stopped because we only had one ball that would fit into the holes. None of the formulas I could find helped at all, so I had to work out my own method.

First I measured the thickness of the plate, the diameter of the ball and the small diameter of the hole. The ball was set into the hole and the distance from the top of the hole to the ball was measured with a depth micrometer. Beta is the angle between the line F and the centerline of the hole. The tangent of Beta was half of A divided by E, where A is the measured diameter of the small end of the hole, and E is the distance up to the center of the ball. Next I found F, which was A divided by twice sine Beta. Angle Gamma was easy to find because its cosine equalled C divided by F, where C is the radius of the ball. Finally Alpha, which is the angle of the taper, was found by subtracting

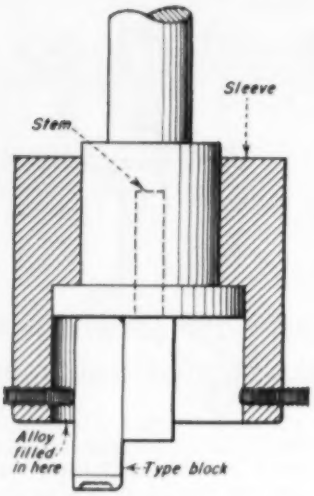
$$E = \frac{\frac{1}{2}A}{\text{Tan } \beta} \qquad \text{Cos } \gamma = \frac{C}{F}$$

$$F = \frac{A}{2 \text{ Sin } \beta} \qquad \frac{1}{2}\alpha = 90 - \beta - \gamma$$



both Beta and Gamma from 90°.

It is simple once you get it doped out, but it took me hours to come up with the answer. Most small-time engineers like myself with little mathematical education would much rather find this sort of a thing in a book than to have to figure it out from scratch. *Frank M. Butrick, Alma, Mich.*



Simple Type Holder Marks Ends of Bar Stock

IDENTIFICATION numbers, serial numbers, or part numbers can be marked on the ends of bar-stock parts with a type holder that is adaptable for round, hex, or square stock.

A mild-steel shank was turned from bar stock to fit in the ram hole of a press, and was drilled to take a number of interchangeable center stems. The stems back up the type numbers, which are located in a circle around the stems.

Fitting around the shouldered shank was a sleeve. Drilled and tapped holes were machined in the sleeves to take setscrews that could be tightened on the type to jam it against the center stem.

Type is first selected, arranged in order, then inserted into the holder between the sleeve and the center stem. After the setscrews are tightened, a low-melting-point-alloy matrix is poured into the remaining cavities, and allowed to cool. Now the type can be utilized without danger of shifting under pressure.

When hex stock is to be marked, a hex or triangular center stem can be inserted in the shank and the type numbers grouped around it. Depending on the size of the type available, varying numbers of digits can be marked on the stock. For square stock, a square center stem is utilized, and for round stock, any stem can be inserted. *Ian J. Peacock, Cumberland, England.*

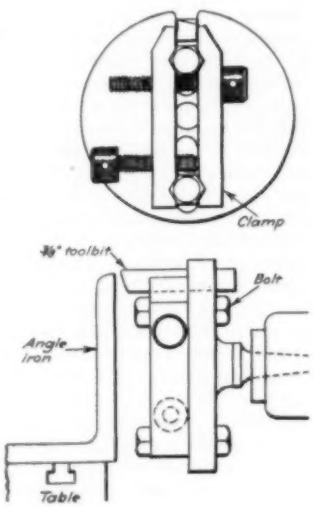
Slow Flycutter Mills Angle-Plate Surfaces

WITHOUT A large end cutter, we could not machine a 6-in. piece of angle iron flat with a normal setup. High accuracy was required on the work, though, so we had to think up something we could improvise.

We took a large clamp, gripped a suitable HSS toolbit in the end, and then bolted the clamp to a lathe faceplate. The work was clamped on the table of a horizontal milling machine, and the faceplate was mounted, by its adapter, in the spindle of the mill. Accurate flycutting was then possible.

For tool adjustment, we simply loosened the two bolts that held the clamp on the faceplate and shifted the clamp. In-feed, of course, was controlled by moving the milling table.

Using a slow feed and speed, we finished each plate in two cuts—one for roughing, and the other for finishing. *E. F. Wallendorf, Lynbrook, N. Y.*



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104th Winner:

J. C. Magee
Hinged Tryout Dies

TALKING SHOP

Bugs

RECENT STUDIES of coolants indicate a tie-in between smell and corrosion. When a batch of coolant gets old, it starts to smell — then watch out. That means that the bacteria that cause rust are thriving — and have developed immunity to ordinary disinfectant in the mix. And the new batch of coolant will last only about half as long as the old — unless the tanks and system are sterilized before it is added.

Prepolished Stainless

ONE LARGE PRODUCER of commercial cooking equipment now buys stainless sheet with polished surfaces, uses grease to prevent damage during forming, so repolishing will not be necessary. Strippable plastic coatings were tried, but proved unsuitable in this case.

Refined Cleaning

DEEPER DRAWS can be made in magnesium than in any other material. One of the major problems is removing the colloidal graphite that must be used as a lubricant. Brooks and Perkins, the largest fabricators of magnesium sheet, have gone far in licking this problem by two refinements in their practice: First, they get raw sheet instead of sheet with a chrome pickle or oiled finish. The slight oxide coating the sheet acquires in storage and shipment makes the graphite much easier to remove, doesn't affect finish of the material. Second, they use a graphite with a slightly coarser particle size. In general, fine particle size permits deeper draws and better finishes; coarse particle size makes for easier cleaning. For most operations, good results are obtained with coarser particles than have been generally employed.

Plea for Plain Carbon

HAVE YOU even seen a duffer lug 15 golf clubs around a course when he could do just as well, perhaps better, with only six? Tom Egan, chief metallurgist at Cooper-Bessemer, thinks we are like that when it comes to specifying metals. We frequently use elaborate alloys when plain carbon steel would do just as well or better. There is a field for each alloy and there are jobs for which an alloy is essential to provide needed properties or fabricating ease. But don't burn up dollars using a high alloy when a plain carbon or low alloy steel will do the job.

Handbooks, Please Note

SPEAKING OF ALLOYS reminds us of the firm that had to switch a part from SAE 1045 to 4140 steel during the war because of a shortage of the plain carbon steel. They had plenty of handbooks available and the change looked simple enough, but it turned out they couldn't get satisfactory drill life with the 4140 —a point the handbooks had neglected to mention.

Rolled Pins

HERE'S A POSTSCRIPT to our article on unusual applications for thread rolling. When you need a pin with a slight shoulder on one end, try rolling the shoulder up from the end of the pin. If the pin is produced in a bar machine, the rolling operation can be formed at one station on the machine. It will reduce the size of bar stock required.

Daffynitions

POST OFFICE: old stamping ground. PROFIT SHARING: Mohammed's wives. MATRIMONY: One state that permits a woman to work 18 hr a day. WALL STREET: where "good buys" may become farewells. RELATIVES: inherited critics. FISHERMAN: fable-minded sportsman. CONGRESSMAN: in favor of economy — in another district. KNOW-HOW: what every company thinks it has, and every company expects its competitors to give away. PRICES: always too high — unless they're yours.

Perspective

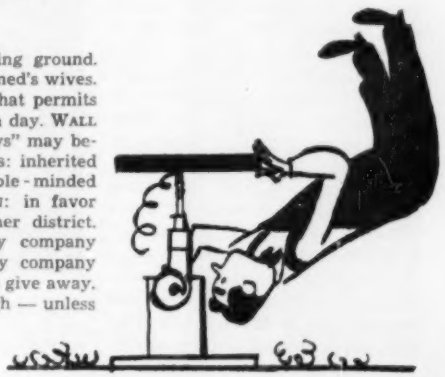
SIR ANTHONY BOWLBY, head of the British delegation to the international conference on standardizing bolt and nut sizes, talked recently of incidents that illustrate problems in developing international standards.

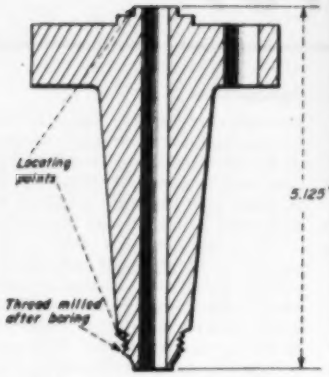
Here's an example: British engineers felt it was quite illogical for us to have nuts that in smaller sizes were larger than bolt heads, but were smaller than bolt heads in larger sizes. Turns out that our standard is not an engineering, but a practical one, based on the fact that smaller bolts are customarily highly stressed (in automotive and aircraft work, for example), large ones are not. Thus, smaller nuts on larger bolts save metal, but make an "irregular" standard. The British conceded, after this explanation.

Incidentally, the British made the great concession of accepting the American standards as a working basis, thus creating an inventory problem for themselves for the next 50 years, but smoothing the path of the conference. They realize that, in international agreements, there are three alternatives: accept the idea of one country or the other, or compromise. But a compromise is usually ignored by both parties.

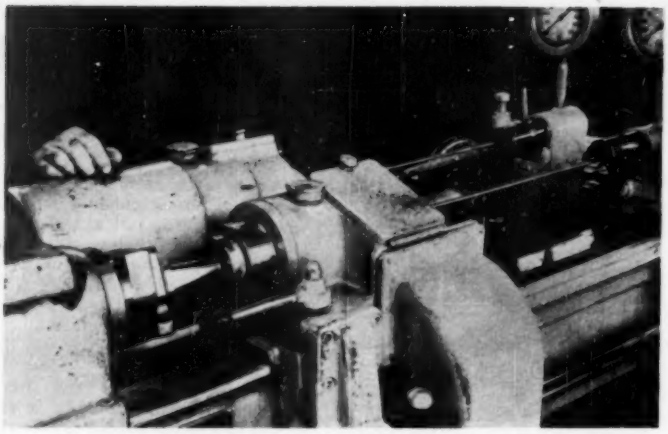
Wrong Way

DR. FRAZER of Union Twist Drill says Metalworking made one initial mistake — starting to drill downward. Chip disposal has been a major problem ever since — and one that grows worse as speeds go up and materials develop a tendency to ball.





Drop-forged injector body is located by its flanged end and turned stem for three bore-finishing operations



Gun-drilling takes place on a Pratt & Whitney machine. Solid SAE 4340 stock is pierced to a 0.0361-in. diameter in a double setup by HSS drills that are oil-flushed

WHY INJECTORS STAY TIGHT

When a diesel-injector plunger will jam in its body after it has been held in an operator's hand for a minute—that's precision. Tolerances of plus 90 millionths, minus zero, are held on injector bodies during large-quantity production at Cummins Engine

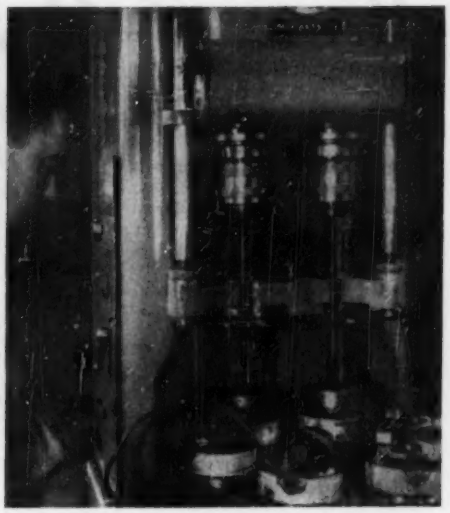
BY CHESTER S. RICKER,
DETROIT EDITOR

RAW STOCK for injector bodies is molybdenum steel hardened to 27-32 Rc. Gun-drilling pierces a 5.125-in.-long hole; then two reaming operations in succession on the same machine enlarge and straighten the hole. The finished diameter is produced by honing with three sets of stones which are automatically sized by a Norbide control ring. After honing, the diameters range from 0.3750 in. to 0.375390 in., leaving a size range of 390 millionths. This is reduced by selective inspection (with Pratt & Whitney air gages and plug gages) which classifies the bores into four groups with a tolerance of 90 millionths each.

Assembled into injector units for diesel engines, the bodies are close enough in dimension to prevent leaks, despite high pressure.

Reaming is done on a six-spindle Ex-Cell-O with a pull slide. Six bodies are loaded into spring-actuated floating holders, and six HSS reamers are inserted in bushings in front of the parts

Reamers couple with the spindles as the spindle slide drops into position. Coolant hoses are attached after the work cycle starts. Final reamed diameter is 0.3705-0.3715 in. and straight

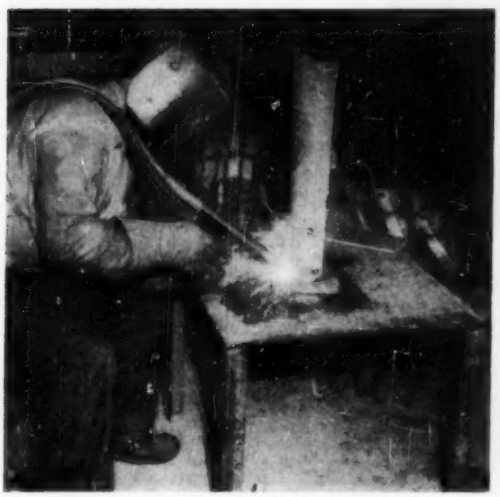


Honing is performed on a double-spindle Micromatic machine with a six-station indexing table. The bodies float freely in adapters while three different stones in each spindle finish the holes

Structural Aluminum Welded by New Process

ANNOUNCED last year as a completely new welding process, Air Reduction's Aircomatic process employs a continuously fed wire as a consumable electrode for welding aluminum and aluminum alloys. The wire is fed to the work through the barrel of a manually operated welding gun, and an inert-gas shield—helium or argon—prevents oxidation and slag formation.

The process is being used by Mid-States Ornamental Iron Works, Kansas City, Mo., for high-speed production of structural members for aluminum awnings, and has been found faster than any other welding technique that might have been used for the job. The process promises substantial economies.



Structural members for aluminum awnings are assembled by Aircomatic welding. Parts are first tackwelded to hold them in position, and then a total of 24 in. of ¼-in. fillet weld is applied to each unit. Operator started production after one day's training on the process

Average welding time for each bracket is 2 min. Wire feed is 210 ipm, using 218 amp and 1/16-in. 43S wire. Helium consumption is 35 cu ft per hr. Process was so economical that one production order of 790 brackets paid for the entire cost of the welding unit

News of Metalworking

McGraw-Hill WORLD NEWS

• **MACHINERY** and equipment authorizations of Marshall Plan commodities for seventeen western European countries totaled $43,515,000 for the week of July 5, ECA has announced. That's nearly 48% of the dollar value of the week's total figure (for all commodities) of $91,922,000.

• **FIRST TRUCK** entirely assembled and equipped in Egypt was turned out last month at new Ford plant at Smouha City, near Alexandria. Daily output now is 12 to 15 light and heavy trucks. The plant is now getting ready to assemble limousines and tractors as well.

• **FRENCH TRACTOR** and other farm implement production will be increased through project approved by ECA, providing for $4,600,000 in ECA financing for purchase of machine tools, tooling equipment and tractor parts for a French affiliate of International Harvester Co., Compagnie Internationale des Machines Agricoles (CIMA). Total cost of project is about $13 million. Tractor output is expected to be increased by 7500 units annually.

• **ITALY EXPORTED** a total of 10,300 tons of machine tools in 1949, valued at 10,000 million lire (some $16 million) as against 17,000 tons valued at about $21 million exported in 1948. Blamed for the decline is devaluation of sterling and, above all, standstill of exports to Argentina caused by inability of Argentina to settle her payments to Italy.

• **PIPE PRODUCTION** is speeded up by new, fully automatic machine for electrically welding pipes up to 4-in. dia., developed by Societe des Echafaudages Tubulaires Burton S.A., at Saint Quentin, in northern France. The machine heats the joint to be welded by induction, through coil located above joint but not in contact with pipe. Up to five tons of pipe per hour can be welded. Pipes of constant length are turned out, eliminating need for measuring. Machine for welding 10-in. seamless pipes is being studied.

War Mobilization Plans of NSRB And Munitions Board in Good Shape

WASHINGTON—Plans for mobilizing the country for all-out war are in good shape. National Security Resources Board has legislation to cover the first six months of conflict all set to go to Congress. It's in the form of stand-by powers. Meanwhile, attempts are being made to finish off plans for a long war, say of five or six years.

• **The production allocation** program of the Munitions Board is up to date. Work now is aimed at finding out just what the military is going to need in the present half-war crisis, just how much of the program will have to be activated, and on what kind of time schedule.

The President already has considerable power to allocate and set up priorities. But he can only guarantee that defense orders will get everything they need. He has no control over how distribution of the residue is handled. In cases where you already have signs of tightness and shortage, as in steel, a grey market would develop immediately as government demands—backed by priorities—put additional strains on. It will take Congressional action to handle that situation.

ENROUTE TO FORD automatic transmission plant in Cincinnati is this giant Fellows No. 10 rotary gear shaper, covered to shield its polished surface from the elements. The 10-spindle gear cutter is one of two purchased by Ford. Speed of turret rotation of the 85,000 lb giant can be adjusted through change-gears to suit any cutting cycle from 2 to 20 min. Each work station is a complete gear-cutting unit. Cutter rotary feeds, based on a cutter of 6-in. pitch dia, range from 0.0096 to 0.0378 in. per cutter stroke

Stand-by legislation worked up by NSRB covers every eventuality in another war, covering 20 titles in all. Essentially, they are all improvements over the most efficient systems worked out in World War II. The big difference is that next war they'll be tougher, will come quicker and with less debate. Price and wage freezes, profit ceilings, manpower draft, allocations and priorities, are just a few of the things you can expect.

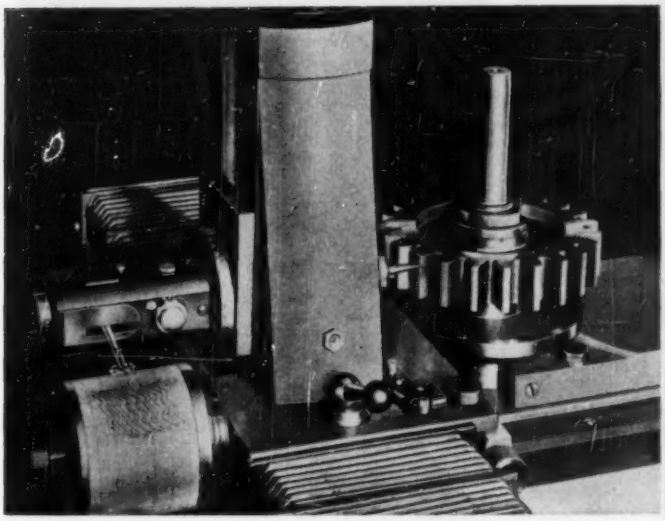
• **Phantom orders** for machine tools are up to date. It takes only money and/or contract authority, and a curt telegram to get orders rolling. Plans to put out more phantom orders for other items that will be needed quickly are being speeded up.

Munitions Board meanwhile has specific plans to get 253 industrial plants into war production on short notice, if needed. Another 200 plants are in reserve, either in a stand-by status or being operated by private industry on the stipulation that they be kept in condition for conversion to war production within 120 days.

In addition to this the Board has a growing reserve of machine tools for use in defense contracts where and when needed. They are in addition to the phantom orders of the NSRB.

• **The Board's stockpiling program** includes some 71 critical materials such as tin, manganese, chrome, nickel, aluminum, mica, asbestos, talc, industrial abrasives, and the like. The only really serious gap in this program is manganese where supplies haven't been accumulated as fast as in other cases due to Russia's embargo. It's serious, but not critical.

Plans themselves are in pretty good shape, but there is still considerable top-level disagreement over just how the programs should be carried out, and who should run them. Agreement is fairly unanimous on what should be done.



TESTING MACHINE for involute spur-and helical gears, developed by W. Ferd. Klingelnberg Soehne at Remscheid, Germany, was one of machines shown at recent Hanover Fair. Testing feeler spindle, with recording mehcanism, is mounted on a traversing column slide which can be either moved tangentially to the wheel, to test contour of tooth flanks, or adjusted vertically within height of 4½ in., for checking any other part of flank. Bellow-like leather sleeves protect guides of column-traverse slide against dust. Machine checks tooth profile, surface finish of tooth flanks, actual dia. of base-circle and angle of contact, and concentricity of gear, independent of pitch differences

West Coast Aircraft Plants Busy De-Mothballing, Modifying Planes

LOS ANGELES — Major aircraft manufacturers here report no immediate orders for new aircraft growing out of the Korean war, but de-mothballing and modifications on World War II aircraft totaling some $21 million have been ordered by the Air Force. Here's the breakdown:

Grand Central Aircraft Corp., Glendale: $13 million contract for modification of Mustangs in Los Angeles, and B-29 Superforts in Tucson, Ariz.

Pacific Airmotive Corp., Burbank: $2.5 million contract for modification of undisclosed number of F-51 Mustang fighters, plus a $1,256,307 contract for reconditioning Pratt & Whitney R-2800 engines.

North American Aviation: Majority of Mustangs they built are being de-mothballed and flown from Texas storage to the coast for reconditioning.

Fletcher Aviation Corp., Pasadena: $3.5 million contract to manufacture fuel tanks of 250-gal capacity.

Slick Airways, Burbank: $1,040,000 contract to modify an undisclosed number of C-46 twin-engine Commando transports.

Douglas Aircraft Co.: De-mothballing of its B-26s going ahead, though not at a greatly accelerated pace.

• **In San Diego,** Solar Aircraft reports orders are coming for exhaust manifolds for de-mothballed piston-powered planes. Orders coming also from eastern jet engine manufacturers for which Solar supplies parts.

Rohr Aircraft Corp. reports constant requests for quotations to supply complete power-plant assemblies for B-50 bomber and C-97s, cargo version of B-50.

Convair is running top speed on B-36 modification program.

In the face of all this activity, International Association of Machinists headquarters in Los Angeles reports a growing scarcity of first class general machinists on the West Coast—particularly in the Los Angeles area.

American Bolt and Nut Sizes Proposed for Unified Standards

NEW YORK—So that nut and bolt sizes will be alike on American, British and Canadian military equipment first, and commercial goods as soon as economically feasible, American bolt and nut sizes have been accepted as a unified standard by delegations from the three countries. Minor modifications in the American standards, suggested by the British for strength or size reasons are:

Nom • Dia of Bolt or Nut	Distance Across Flats Bolt	Nut
1/4	7/16	7/16
5/16	1/2	1/2
3/8	9/16	9/16
7/16	5/8	11/16
1/2	3/4	13/16
5/8	15/16	1

The British will have to make new header dies and wrenches. With detail refinements proposed and accepted, American, British and Canadian screw threads, bolt and nut sizes, and wrench openings will be interchangeable. Screw threads were unified two years ago.

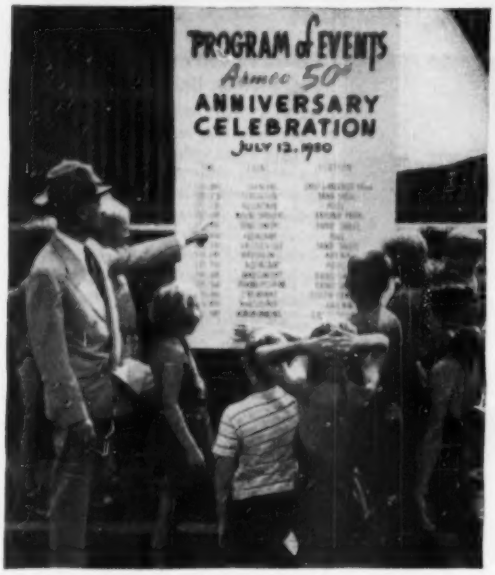
Reid Celebrates 50th Anniversary

BEVERLY, MASS.—Reid Brothers Co., Inc., is celebrating its fiftieth anniversary this year. Founded by Robert and Andrew S. Reid, the company has grown from a small shop to a modern factory building in which Reid surface grinders and Post straight line gluers for use in manufacture of folding cartons, are made. The gluer is a new postwar product developed by a new division of the company, the Post Machinery Co. During World War II Reid Brothers produced shell turning lathes as well as surface grinders.

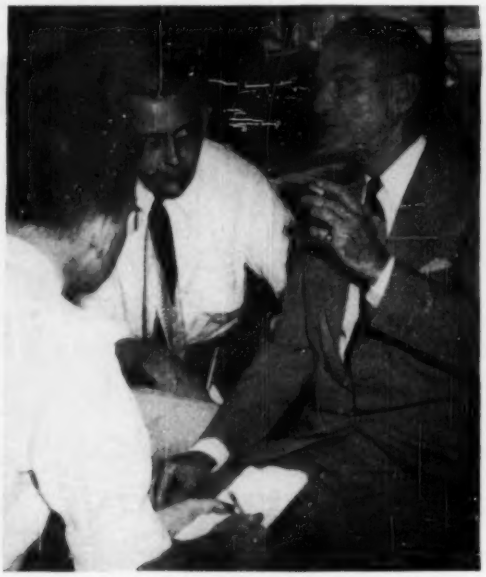
Walter W. Perkins is president of the company; Walter P. Fergnani is president of the Post Machinery division; Thomas J. Toomey, treasurer; Robert F. Reid, assistant treasurer; John U. Reid, vice president; and James Field, vice president.

SAE Schedules West Coast Meeting

LOS ANGELES — Continuing detail improvement in design, development, and operation of land vehicles and aircraft, and of their powerplants, will be reviewed here August 14-16 at the National West Coast meeting of the Society of Automotive Engineers. A feature of the technical sessions will be a talk on "Gas Turbine Propulsion for Ground Vehicles."



ARMCO STEEL CORP. observed its 50th anniversary July 12 by treating thousands of Middletown, Ohio, residents to hot dogs, ice cream, soft drinks, cracker-jacks and, as pointed out here by President W. W. Sebald, some top-notch entertainment. The town shut down stores and offices and went to the ten-hour party, which was put on in Sunset Park by committees of 1500 Armco employees



THE CELEBRATION also marked the 70th birthday of Armco Board Chairman Charles R. Hook, who is shown here being interviewed on the steel situation by AMERICAN MACHINIST's Anderson Ashburn and an unidentified Cincinnati reporter. Mr. Hook revealed that three new 225-ton open hearth furnaces now under construction will boost Armco's production rate by 600,000 tons per year

Productivity Gain of 25% Seen As Possible in Next 5 Years

NEW YORK—American industry should gain up to 25% in productivity (output per manhour) the next five years, if capitalism in this country performs as well as it should, Dexter Merriam Keezer states in his new book "Making Capitalism Work" (McGraw-Hill Book Co., $3.50).

Mr. Keezer points out that 'the nation is, at least potentially, on the threshold of sweeping gains in productivity . . . By improving its productivity, the United States can produce the materials to meet the most pressing demands on the economy. And it can do it while maintaining industry's tooling program at a level high enough to ensure a continuing rise in living standards."

• **Major parts of the task** of realizing the increase in productivity, Mr. Keezer states, are these:

(1) Providing tools and equipment (the capital) essential to effective utilization of our economic resources, human and material.

(2) Assuring vigorous utilization of these resources, largely a matter of incentives.

(3) Seeing that industry's proceeds are fairly divided—largely a matter of giving fair competition every possible encouragement and protection.

(4) Protecting the economy from violent destruction, either by depression or more directly revolutionary operations.

(5) Providing enough individual economy security to remove destructive fear of poverty or humiliating dependence upon charity, but not enough to make reliance upon social security an attractive career.

(6) Producing economic foundations for rising standard of general well-being, identifying capitalism with that advance, and otherwise creating an hospitable social and political climate for capitalism.

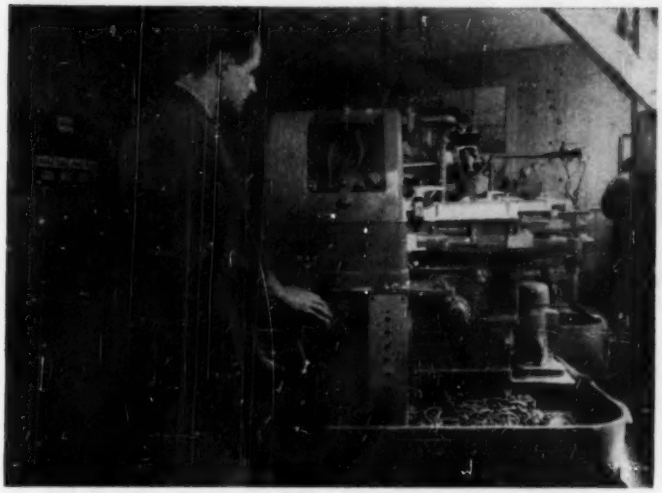
(7) Treating our resources, both human and material, with decent regard for aesthetic sensibilities of present generation and economic needs of generations to come.

(8) Creating a tolerably congenial political and social environment for capitalism by successfully demonstrating its compatibility with basic American ideals.

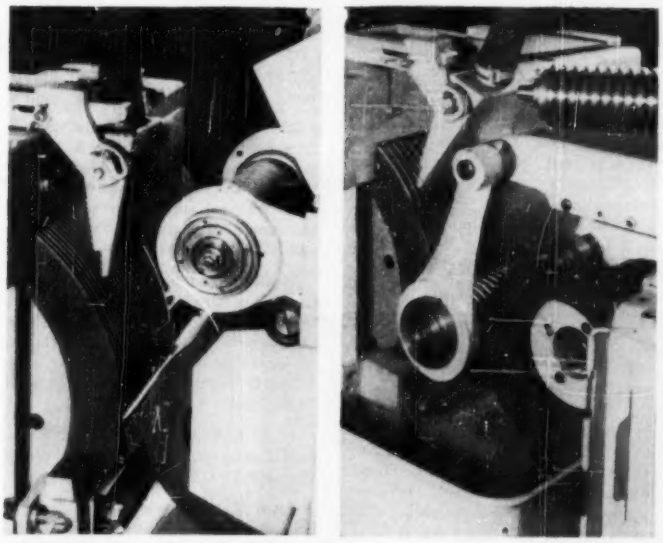
Mr. Keezer contends that capital expenditures by business must be maintained at a high level if capitalism is to survive, if the nation is to meet all the many demands upon it, and if we are to have continuing prosperity. That, in fact, is the book's main theme. It suggests that the nation continue to plow back about 9% of its total product in new industrial facilities. In the years ahead, business will have to raise $4-$6 billion a year from investors through sales of stock.

• **The outstanding danger** to capitalism, Mr. Keezer declares, is that the nation will turn to the idea that the federal government can offset any decline in private investment by lending money to business on attractive terms or by investing directly in new industrial plants.

William F. Butler, Peter French, Marcia C. Gauger and Robert P. Ulin of the McGraw-Hill Department of Economics were associated with Mr. Keezer in preparing the book.



NEW SINGLE-SPINDLE AUTOMATIC TURRET LATHE, developed by Tarex Ltd., Geneva, Switzerland, will be demonstrated at the Chicago International Trade Fair, August 7-20. Unusual feature of machine is that it can be used for both bar and chuck work without changing the spindle. To convert from bar to chuck, the collet location is changed and feed tube removed. The chuck is then mounted on the spindle nose and operated by same device as for bar work. An air-operated chuck and automatic spindle locator for cross drilling with the turret can be applied. Machine is equipped with nine standard cams. Variable lever ratios produce different strokes, and feed can be altered simultaneously with the same cam. It lends itself to short runs because similar components can be machined with one set of cams



BRITISH WHEEL-CRUSHING DEVICE for centerless grinder requires no independent motor drive, and superstructure of the machine need not be strengthened. The crusher roll is mounted on a pivoted arm. To crush dress the wheel, the arm is swung down so that the crusher is positioned between grinding wheel and control wheel. The latter applies the crushing pressure, and its rubber face is indented only 0.015 in. Arthur Scrivener Ltd., Birmingham, is maker. Left photo shows wheel-crushing unit raised; at right, unit is in lowered position

Distributors Named

Lodge & Shipley Co., Cincinnati, has named five new distributors: Gilles Machinery Co., Cleveland; John E. Livingstone Co., Detroit; Edmond E. Burke Co., Toledo; Strauss & Hass, Inc., New Orleans; Peerless Supply Co., Inc., Shreveport, La. Sales and service in the Cincinnati area will be handled directly by the factory office.

Sier-Bath Gear & Pump Co., North Bergen, N. J., has named G. W. Bush Co., West Hartford, Conn., exclusive New England distributor for precision gears and flexible gear couplings.

C. E. Johansson Gage Co., a division of Swedish Gage Co., Detroit, has been named distributor, for U. S. and Canada, of Johansson gage blocks and accessories and other products made by Aktiebolaget C. E. Johansson Co., Sweden.

Tube Turns, Inc., Louisville, Ky., has appointed J. T. Wing & Co., Windsor, Ontario, distributor of Tube-Turn welding fittings and flanges. J. T. Wing will represent both Tube Turns, Inc., and its subsidiary, Tube Turns of Canada, Ltd.

Cogsdill Twist Drill Co., Detroit, has appointed the following distributors: Wilson-Garner Co., Detroit; Tool Reserve Corp., Chicago; Kut-Rite Tool Co., Chicago; Nelson & Storm Tool Supply, Rockford, Ill., Buehler Equipment Co., Philadelphia; Haines Tool Co., Cleveland; Industrial Sales & Service, Inc., South Bend, Ind.

Atlas Chain & Mfg. Co., Philadelphia, has named Bernstein Brothers, Inc., Paterson, N. J., distributor in the north New Jersey and Paterson-Passaic area.

Butterfield Div., Union Twist Drill Co., Derby Line, Vt., has named Garner-Shelton Co., Detroit, distributor in the Detroit area.

Multifinish Mfg. Co., Detroit, has named Udylite Corp., Detroit, national distributor for rotary tank Magnetools.

Carboloy Co., Inc., Detroit, has named Erie Mfg. & Supply Corp., Erie, Pa., distributor for Erie and northwestern Pennsylvania.

John F. Miller

August Ehrhardt

Val G. Kessler

Jesse L. Powers

Names in the News

John F. Miller has been elected vice president of Illinois Tool Works, Chicago. He joined the firm last September as manager of the Tool Div. In addition to managing the engineering, manufacture and sale of metal cutting tools, Mr. Miller will direct development of the firm's new line of graphic inspection equipment.

Andrew E. O'Leary, consultant for American Machine & Foundry Co., New York, in the St. Louis area since early 1946, has been transferred to Cleveland to direct sales in the eastern Ohio territory.

George I. Bottcher has been named chief engineer, Allegheny Ludlum Steel Corp., Pittsburgh. **J. F. Chapman** and **R. E. Smith** have been named his assistants.

Harlow F. St. Pierre, formerly assistant sales manager, has been named to the newly created position of manager of the industrial castings sales division of Hunt-Spiller Mfg. Corp., Boston.

August Ehrhardt, since 1945 master mechanic of Spicer Mfg. Div., Dana Corp., Toledo, has been named to the general tool engineering staff. **Val G. Kessler** has been named master mechanic of the Toledo plant. In his new post Mr. Ehrhardt will seek improvements in machine tooling operations in the corporation's divisional plants. **Sherman Peters** has been named assistant master mechanic, succeeding Mr. Kessler.

Charles A. Butcher has joined Worthington Pump & Machinery Corp., Harrison, N. J., as assistant to the president. He formerly was general manager, Crocker-Wheeler Mfg. Co., and vice president to its successive parent companies, Joshua Hendy Corp. and Elliott Co. **C. F. Harwood** and **Frank D. Shumate** have retired. Mr. Harwood joined Worthington's predecessor company, International Steam Pump Co., in 1903. In 1945 he was named assistant to the vice president at Worthington. Mr. Shumate joined Worthington in 1906 as a sales engineer.

OBITUARIES

Gustav H. Zimmer, 68, former chief engineer, Machine Tool Div., Buffalo Forge Co., Buffalo, N. Y., died June 29. He joined Buffalo Forge's Engineering Dept. in 1908, and soon after became chief engineer. He retired several months ago because of illness.

Richard G. McElwee, 60, manager of the Iron Foundry Div., Vanadium Corp. of America, Detroit, died June 21.

Wilbur H. Stacy, comptroller at Harrison Works, Worthington Pump & Machinery Corp., Harrison, N. J., died June 23.

Dr. Trygve D. Yensen, 66, manager, Magnetics Dept., Westinghouse Research Laboratories until he retired June 30, died July 2. He was a leader in development of a series of new alloys that have improved performance of electric motors, generators, and transformers.

Jesse L. Powers has been named general superintendent on special assignments at Buick Motor Div., General Motors Corp. Mr. Powers, veteran superintendent of the Buick engine plant, is succeeded by **Stanley White,** who has been his general assistant superintendent for the past three years. **Jerry B. Doll,** assistant superintendent of the engine plant, was named superintendent of the service parts manufacturing plant, succeeding **T. J. Johnson,** retired.

E. M. Platts, sales vice president, has been elected executive vice president of Joy Mfg. Corp., Pittsburgh, to succeed the late **Arthur S. Knoizen.** Mr. Platts joined Joy in 1945 through Joy's acquisition of LaDel Conveyor & Mfg. Co., which Mr. Platts had served as vice president.

Edmond J. Hagan has been named sales representative, Press & Power Tool Dept., Baldwin Locomotive Works, working out of the New York district sales office. He will cover northern New Jersey, New York and New England.

Mead W. Batchelor, former executive vice president of Bridgeport Brass Co., Bridgeport, Conn., has been named to succeed **N. C. Harris** as works manager of the two Chase Brass & Copper Co., Inc., plants in Cleveland.

F. F. Roehll has been named national sales manager, Eutectic Welding Alloys Corp., New York.

Fred H. Pillsbury has been named president of Century Electric Co., succeeding his father, **Edwin S. Pillsbury,** who will continue as chairman of the board. The new president has been vice president in charge of operations since last July and a director since 1942.

H. A. Roemer, Jr.

Clarence H. Linder

George E. Burens

George Demougeot

H. A. Roemer, Jr., has been elected president, director, and member of the executive committee, Sharon Steel Corp., Sharon, Pa. He succeeds **Henry Roemer,** who continues as board chairman. **A. M. Tredwell, Jr.,** was elected vice president.

Joseph J. Ramge has joined the sales staff of Nichol Machinery Co., Inc., Milwaukee. He was formerly with Westinghouse Electric Corp., Cincinnati Gilbert Machine Tool Co., and Ohio Machine Tool Co.

C. Stewart Ferguson has been named technical director, Marshall-Eclipse Div., Bendix Aviation Corp., Troy, N. Y. He was with General Electric Co. for 31 years, recently as manager of GE's west coast chemical operations.

John F. Gordon, vice president of General Motors and general manager of Cadillac Motor Car Div., has been named in charge of the engineering staff, succeeding **James M. Crawford,** who is on a disability leave of absence. **Don E. Ahrens,** general sales manager of Cadillac since 1935, succeeds Mr. Gordon as general manager. Mr. Ahrens also has been elected a vice president of GM and named to the Administration Committee.

Clarence H. Linder, formerly assistant to the general manager of General Electric Co.'s Apparatus Dept., has been named manager of engineering and acting manager of manufacturing of the company's Affiliated Mfg. Companies' Dept. **George E. Burens,** manufacturing manager of the Affiliated Mfg. Companies' Dept. has been named acting general manager of Locke Inc., G-E affiliate in Baltimore. **Dr. Lewi Tonks,** physicist in the G-E Research Laboratory, has been named head of the Physics Div., Knolls Atomic Power Laboratory. Three new appointments in the G-E Small & Medium Motor Div. are: **D. E. Moorhead,** administrative assistant to the manager; **O. F. Vea,** manager of sales; and **F. B. Hornby,** manager of engineering. **Floyd C. Pickett** has been named assistant to the works manager, Fitchburg Works.

Warren L. Smith, former senior vice president, has been elected president of M. W. Kellogg Co. New York (Pullman, Inc., subsidiary), succeeding **Harold R. Austin,** retired. **Bennett Archambault,** former treasurer, was elected vice president and general manager. **G. Frank Bayes, Ronald B. Smith** and **Zary A. Toula** were named vice presidents.

George Demougeot has been named plant manager of Sperry Products, Inc., Danbury, Conn. He was formerly plant manager, Ronson Art Metal Works, Inc., Watson Flagg and Fairchild Engine & Airplane Corp., and was director of manufacturing for Fairchild. He has also been associated with Bendix Aviation Corp. and Carrier Corp.

Maynard T. Murray has been named manufacturing manager, General Manufacturing Div., Ford Motor Co. He has served the division as manager of quality control and, more recently, as acting manager of the Canton Forge plant. **Burton O. Heinrich,** former assistant manager of the Canton plant, succeeds Mr. Murray as plant manager.

David E. Davidson has been elected vice president of sales, Link-Belt Co., Chicago. He was formerly general manager of the company's Pershing Road plant., where he is succeeded by **Eugene P. Berg,** formerly assistant general manager.

H. Dudley Swim has been elected chairman, Baker-Raulang Co., Cleveland; **Clarence M. Taylor** has been elected chairman of the executive committee, and **John R. Morrill,** vice president in charge of sales.

John F. Gordon

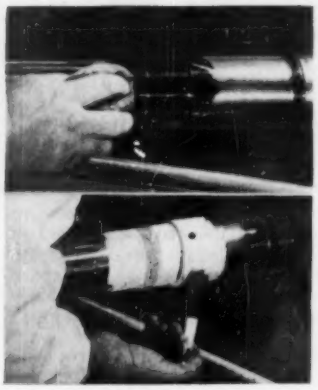
Don E. Ahrens

Clarence M. Taylor

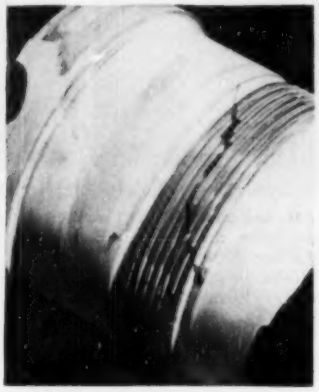
John R. Morrill

New Shop Equipment

1 Red penetrant is applied to surface, after cleaning, and allowed 5 to 15 min to penetrate any flaws



2 Dye is removed from surface with volatile solvent (top), and white developer is brushed on



3 Flaws show up as red dye is drawn out by developer, showing outline of defect against white background

Dye Penetrant Reveals Surface Cracks, Flaws

A general-purpose process for quick detection of surface cracks and flaws requires only a paint brush, spray booth, or dip tank. Developed by Northrup Aircraft, Inc., the dye penetrant method—DPM—can test any metal in 10 to 20 min without disassembling the parts.

DPM provides a foolproof check on whether a scratch is simply a scratch or a deep flaw. With experience it is possible to determine the depth, width, and kind of flaw.

Key to DPM is a penetrant liquid of unusually high capillary action and correspondingly low surface tension. It contains a brilliant red dye in a super-saturated solution. The penetrant finds its way into unseen, hairline flaws and will work through these from one abnormality to another, detecting surface flaws, crater cracks, lack of fusion and porosity. In fact, it will penetrate any surface and sub-surface flaws that have a surface manifestation.

In addition, the method requires a solvent to clean the surface before the dye is applied and to remove the dye from the surface, and a white developer which bleeds the dye out of the flaws.

The penetrant can be used after parts have been welded, heat-treated, ground, or after any machining process. It will detect fatigue cracks in engines and all types of machinery.

An advantage over standard inspection methods is that the process works equally well on magnetic and non-magnetic metals. The only metals on which it will not work satisfactorily are porous castings.

For maximum sensitivity to small flaws, the parts should be warmed to 100 to 150 F, but room temperature is warm enough for most applications. The dye is allowed 5 to 15 min to penetrate depending on the extent and thinness of the suspected flaw.

Interpretation is said to require only a little practice. For instance, a red line indicates a crack or cold shut; a series of red dots in a line indicate a tight crack, cold shut, or partially welded lap. The extent of the opening is estimated by the width of the indication or by the amount of spreading of the penetrant on the white developer. Red dots indicate pits or porosity.

The process is not recommended as an absolute substitute for all other methods, but it has proved a sure double check. It has been used as the sole method on hard-to-dismantle components.

DPM was developed by Northrup chemists and engineers, among them Rebecca H. Smith, chief metallurgist for the Turbodyne Corp., a Northrup subsidiary.

Dy-Check Co., Hawthorne, Calif.
(MORE DATA? CIRCLE FYI 31, p. 163)

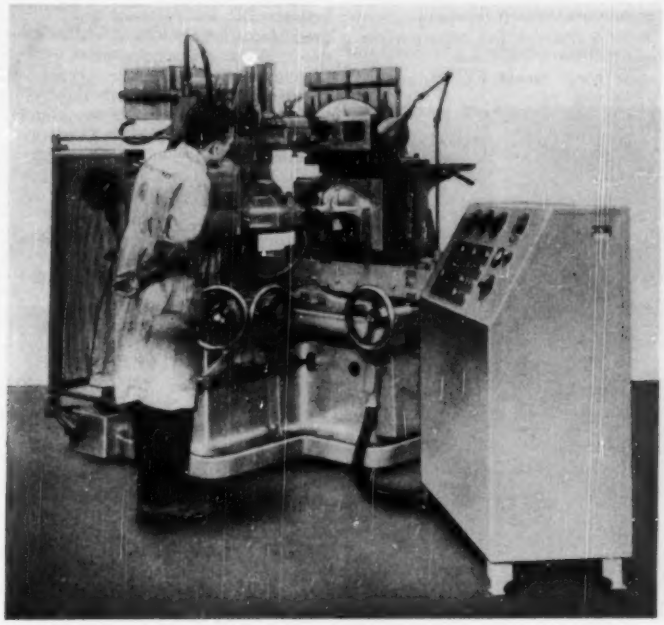
Carbide-Edged Cutters Designed for Hard Material

Cutters which have tough carbide edges brazed to the cutting jaws have been designed for cutting extremely hard material such as stainless-steel rods, wires, and pins up to ⅜ in. diameter.

Hot-metal cutters similar in design to the carbide-edged type have been developed for use in cutting hot steel bars, rods, and wire up to ⅝ in. diameter. They are of hot-work steel and have heat-treated jaws to insure long life under continuous duty.

H. K. Porter, Inc., Somerville, Mass.
(MORE DATA? CIRCLE FYI 32, p. 163)

Materials and Parts



Automatic Tracer Altered In Keller BL Milling Machine

A development of automatic electric tracer control by Pratt & Whitney is said to enable the tracer to glide smoothly over any contour two to three times faster on finishing operations. The feature of the control is an automatic tracer which, operating in conjunction with an automatic variable-speed control, provides continuous variation of the machine motions in proportion to the slope being followed.

Drives having a single shift and magnetic clutches driven by individual variable-speed motors replace units with four gear shifts. The magnetic clutches engage or disengage instantaneously under command of either pushbutton control or the tracer.

Travel speeds are infinitely variable from 0.5 to 30 ipm and are completely controlled from the operator position through solenoid shift of the gears and rheostat control of the motors. Step feeds of limited range previously set at each gear box have been replaced with a single unit mounted in the control cabinet, giving a range of feed from 0.010 in. to 4 in. in increments of 0.010 in.

Cutter breakage by overloading is eliminated through a power-limiting circuit which interrupts the travel motion when a pre-set cutter load is approached.

Automatic reversal of either vertical or horizontal travel motion at the edge of an irregular form or cavity, rather than at a fixed length of travel, eliminates non-cutting time. This type of reversing can be used at either end of the stroke, at both ends of stroke, or combined with a fixed point at the opposite end of the stroke.

Basic structural design of the Keller BL has not been altered. Horizontal-spindle construction permits the use of a constant flood of coolant to wash the chips from the deep cavities and allow the cutter to operate

... INCLUDING

Electronic computer calculates time-study schedules and waiting time..... page 158

Milling machine with heavier columns and increased horsepower takes higher feeds.....page 159

Bending press has shut height of 30 in. to take a large gooseneck punch .....page 160

Stainless-steel tube that work-hardens slowly, stands up under severe cold-forming.....page 162

Fork truck has inclined kingpin to increase ease of steering and straightening out.....page 166

Horizontal boring machine features extended bed that supports motor and gear boxes...page 168

Power squaring shears have automatic hold-down action because of compression springs..page 172

New Bulletins for your Shop Library, including a 42-page catalog giving details on retainers, punches, and die buttons .....pages 163 and 164

... and in August 7

Engine lathe developed with gearbox and end gearing totally enclosed, has extra-wide helical gears in headstock.

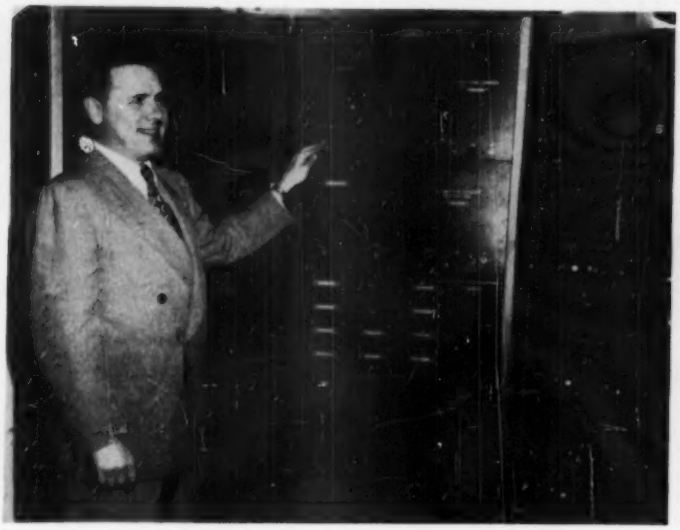
Dynamic micrometer measures a metal body's vibrations or movement with a sensing coil that has no physical contact with the metal.

at maximum efficiency. A large worktable permits direct overhead loading, and also makes it possible to mount jobs far beyond the working range of the machine. With the workpiece and model mounted on the same fixture, both can be swiveled or tipped together to get at deep corners. A wide range of spindle speeds is provided, ranging from 80 to 3600 rpm.

The control cabinet, located at the operator's position, contains a panel of pushbuttons and selector switches, each clearly marked as to the functions they perform. Complete control of all motions, including speed and feed changes, are made from this one centralized location.

Pratt & Whitney, Div. Niles-Bement-Pond Co., Hartford, Conn.

(MORE DATA? CIRCLE FYI 33, p. 163)



Electronic Computer Determines Production Schedules, Waiting Time

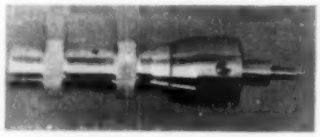
"Time-study computer" simulates machine and operator actions through electronic tubes, and can "perform" a day's work in seconds. Used to study frequently changing combinations of automatic machine cycles, it calculates the production on each machine of a group, and the waiting time during which the operator is not loading any machine. The long work involved in computing the allowance for waiting time is eliminated by the device, which completes payroll or production studies quickly and with unbiased accuracy.

The computer can simulate the operation of as many as ten different machines at one time. Each individual loading and running time which has been determined by usual time-study methods is set into the computer in decimal minutes. A press of a button, and the computer simulates operator and machines for any preset period, at a speed of 1000 elements of time per second. The computer is operated by one person who sets the dials from work slips.

Built in three panels, each 6 ft high and 2 ft wide, the controls can be reached from a seated position when arranged in a semi-circle. The time-study machine operates on a regular light circuit and costs approximately $15,000.

Potter Instrument Co., 136-56 Roosevelt Ave., Flushing, L. I., N. Y.

(MORE DATA? CIRCLE FYI 34, p. 163)



Torque-Controlled Screwdriver Insures Proper Loading

A given value of applied torque will automatically disengage this mechanically operated screwdriver. The device is preset in the factory for any cutoff value desired.

It is claimed the screwdirver will prevent broken bolts and stripped threads and will protect fragile materials from damage when tightened. If used as an intermediate section between the drive spindle of a drill-press and a tap, breakage of the tap due to clogging and subsequent overload is avoided.

The unit is available for both hand- and power-driven operations. Hand model is priced at $15.95. The combination model has a detachable handle and is priced at $25.95. Resettings of torque are free of charge for all models.

Overload Control Co., 260-63 Langston Ave., Glen Oaks, L. I., N. Y.

(MORE DATA? CIRCLE FYI 35, p. 163)

Automatic Soldering Iron Weighs Only 4 Oz

Instant-heating Solderweld iron is a miniature model which will work from a 6-volt source, either a battery or a line transformer. Current is drawn only when soldering is actually taking place, so power drain is quite low. The tool is especially designed for small work in repair shops or on production lines. Operation is completely automatic.

Palmer Mfg. Co. Inc., Woodside, L. I., N. Y.

(MORE DATA? CIRCLE FYI 36, p. 163)

Moisture Absorption Lessened On Packaged Cut-Off Wheels

Cut-off wheels are being packaged in glassine, heat-sealed envelopes to avoid damaging moisture absorption. Bond holding the abrasive particles to the wheel loosens its hold if moisture is allowed to work on it. Envelope lessens moisture pick-up, keeps wheel clean, renders instant identification.

Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill.

(MORE DATA? CIRCLE FYI 37, p. 163)

Metal Cleanser Employs Di-Phase Principle

Di-phase metal cleaners are used in a system in which the water and solvent remain as separate layers. The cleaner consists of a chlorinated solvent such as trichlorethylene to which is added mineral spirits to give a final specific gravity greater than the water layer. Polyethylene glycol 400 (di tri) ricinoleate S-556U is added to help remove grease and oils.

Cleaning by this Di-phase system is done by dipping the metal parts through the water layer into the solvent, and then within a short time bringing them up through the water layer.

Glyco Products Co. Inc., 26 Court St., Brooklyn 2, N. Y.

(MORE DATA? CIRCLE FYI 38, p. 163)

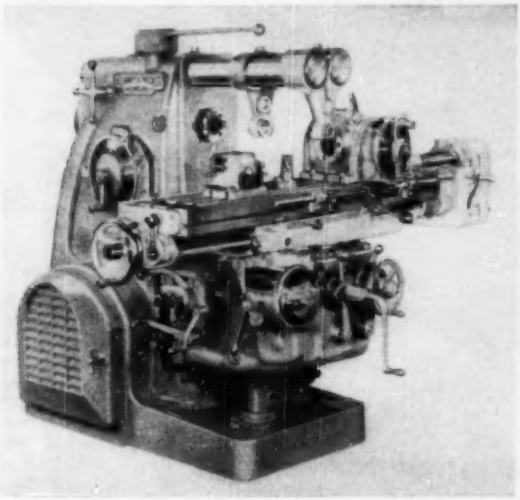
Emulsion Oil Prevents Rust

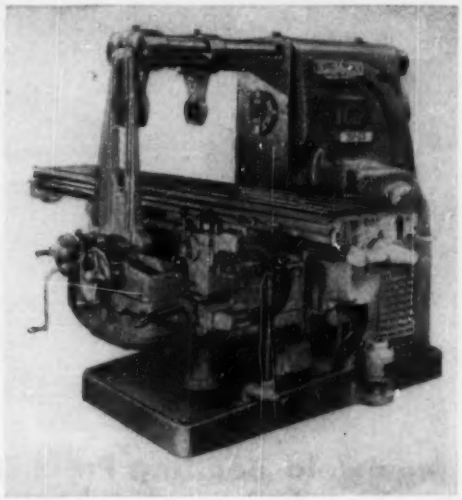
Cutting oil deposits a light, rust-preventive film on work and tools while performing primary functions of lubrication and cooling. The lubricant is known as Cool-Cut and is used in water to create a water emulsion. Concentrations vary with the machine operation involved.

Manufacturer claims it has long tank life, does not separate, form carbonized film, turn rancid, or create an unpleasant odor even after extended use. A companion product, Turco 2778, is used with Cool-Cut to give additional rust-prevention.

Turco Products Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

(MORE DATA? CIRCLE FYI 39, p. 163)





Kearney & Trecker CK Millers Have Heavier Columns, Greater Horsepower

A line of general-purpose knee-type milling machines, in plain and universal styles, has been announced by Kearney & Trecker. Designated as Model CK, the group of machines is offered in five sizes (No. 2, 3, 4, 5, and 6).

Principal features include: Sturdier columns, heavier by 1,000 to 1,200 lb depending on machine size; Spindle-mounted flywheel, running with three-bearing support; Heavy-duty (2-in-dia) table feedscrew, extra-long bronze nut, and positive backlash eliminator; Increased power ratings coupled with independent motor drives for spindle and for feed and rapid traverse. Spindle and feed motors are interlocked with automatic safety control for overload conditions, preventing cutters from stalling in the cut. Spindle-horsepower ratings of these milling machines, according to size, are as follows: 10 hp, No. 2; 15 hp, No. 3; 35 hp, Nos. 4, 5, and 6.

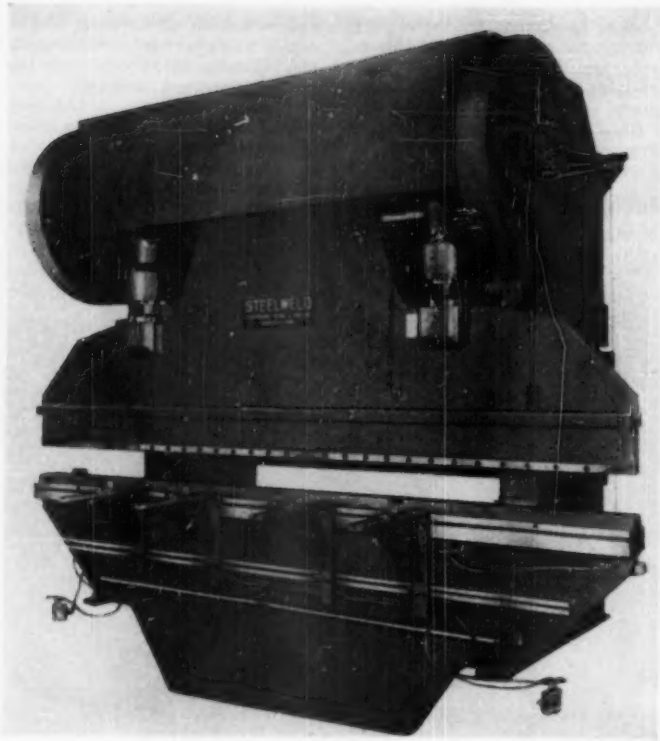
Among other innovations is a double-duty spindle nose on Nos. 4, 5, and 6 size machines. In addition to the conventional No. 50 National Standard spindle nose, a No. 60 heavy-duty driving flange has been integrally forged with it to permit improved cutting efficiency when large-diameter face mills, or flange-type arbors for large-diameter side and slot-milling cutters are used.

Feed changes from ⅜ to 90 ipm are provided on all machines, and there are 24 spindle-speed changes. The speed range on No. 2 and No. 3 machine is 15 to 1500 rpm, and 13 to 1300 on Nos. 4, 5, and 6. Gear clashing and changing speeds is eliminated by an automatic protecto-mesh controlling system. The micrometer dials have high-contrast figures and increment markings for improved legibility, and fast, positive locking at every setting.

A hypoid-type universal spiral dividing head has been installed in the machines. This head has an indexing ratio of 5 to 1 between spindle and hand crank. Another feature is the non-sticking taper No. 50 National Standard spindle, conforming to the machine spindle, with which standard milling-machine tools can be used interchangeably. Chucks and face plates are mounted direct without special adapters. Preloaded ball-bearings are used in mounting the dividing-head spindle to overcome oil film float and assure a constant factor of accuracy during the lifetime of the dividing head.

Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

(MORE DATA? CIRCLE FYI 40, p. 163)



Steelweld Bending Press Designed for Gooseneck Punch and Standard Dies

Steelweld bending press Model MO6-12 has a bending capacity of 500 tons, and will bend up to ⅜-in. plate 20 ft 6 in. long. The machine is designed to take a large gooseneck punch, and for this reason has a shut height of 30 in. Ram is provided with an extension which brings shut height down to 16 in. with standard dies.

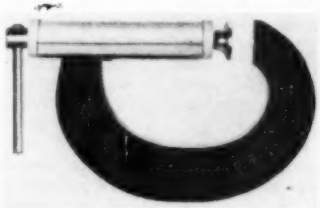
Bed and ram length is 20 ft 6 in., while over-all height is 17 ft 1 in. Depth of the bending press is 9 ft 0 in., and the distance between housings is 12 ft 6 in. Deep 18-in. throat is standard on all large Steelweld presses. The press has a 6-in. stroke, with two speeds of 7 or 20 strokes per min. The clutch is air-operated and controlled by two foot-operated valves. Reverse flywheel permits reversing the ram at any position of the stroke.

The bed is provided with a slide rail on which are mounted four brackets, adjustable up and down and along the bed, for supporting materials going through the machine. The brackets have adjustable stops that enable gaging the width of metal being formed.

Fabricated entirely of heavy rolled steel plate by welding, the frame of the machine under full load allows an average deflection of not more than 0.001 in. per ft between housings.

Cleveland Crane and Engineering Co., Wickliffe, Ohio

(MORE DATA? CIRCLE FYI 41, p. 163)



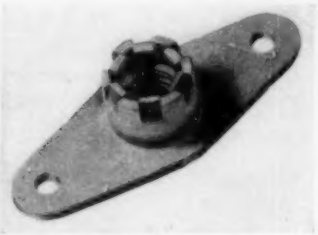
Shielded Welding Clamp Offered in General Service Size

Jorgensen shielded welders' clamps have been adapted to a general service weight of clamp in Style No. 120-S. The clamp is conventional in all respects except for the addition of a steel shield over the full length of the clamp screw. The shield protects the screw from "spatter" and other welding damage.

The Style No. 120-S is available in all sizes from 2- to 12-in. opening capacities; load limits, depending upon the particular size, run from 2400 to 4500 lb.

Adjustable Clamp Co., 417 North Ashland Ave., Chicago 22, Ill.

(MORE DATA? CIRCLE FYI 42, p. 163)



Self-Locking Nut Formed By Depressing Threaded Flanges

Plate Lok nuts have been added to a line of hexagon nuts by the Boots Aircraft Co. These nuts use a principle called "Hex-Lok." The top locking section is formed by depressing six threaded flanges inward and downward, so that they exert positive pressure against the body of the bolt, without distorting or breaking the bolt threads. These flanges are held by tension in this out-of-phase condition, and return to a depressed position when the bolt is removed.

Boots Aircraft Nut Corp., Stamford, Conn.

(MORE DATA? CIRCLE FYI 43, p. 163)

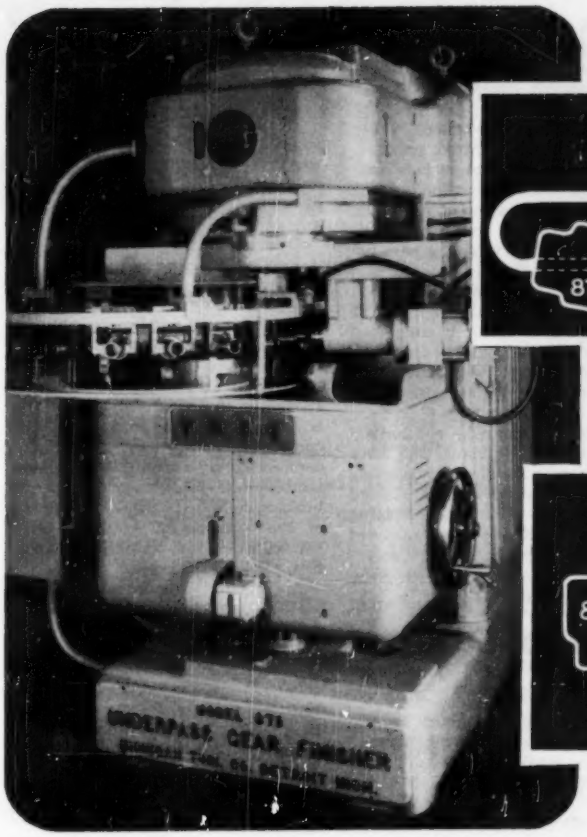
One-Coat Spray Forms Hammer Finish

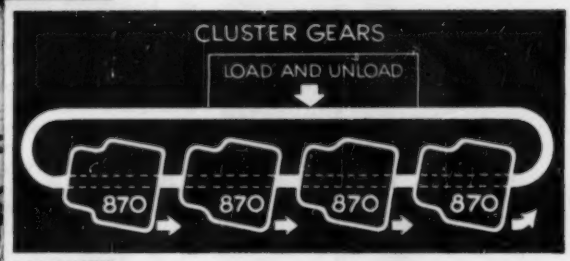
To eliminate variations in hammer-effect finish caused by different techniques used by different sprayers, a new one-coat finish has been developed to be sprayed at the same pressure as regular enamel. The finish is called Un-i-loid.

Tests on oil burners, refrigerator equipment, and sanitary containers have produced good results. The material is available in many colors and in either a bake or air-dry finish. Baking time is 20 min in gas oven at 300 F or 8 min under infra-red lights. The air-dried finish can be handled within an hour and will dry hard overnight.

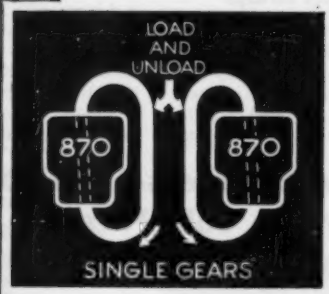
United Lacquer Mfg. Corp., Linden, N. J.

(MORE DATA? CIRCLE FYI 44, p. 163)





with conveyorized gear finishers



Michigan CUTS GEAR COSTS *Again!*

Gears can now be finished completely automatically ON A CONVEYOR—without manual or subsidiary mechanical machine loading.

Michigan's improved 870s are now so designed that conveyors can pass right THROUGH THE MACHINE. Each gear stops for a few seconds to be finished—then travels on with the conveyor.

Cycle time on the installation shown here is 17½ seconds for finishing—2½ seconds for conveyor movement between operations—20 seconds per gear TOTAL.

The same conveyor can be passed right through several 870 machines, if desired, to automatically finish all gears on a cluster.

Loading or unloading gears from the conveyor is simplicity itself. The touch of a finger separates the jaws which hold the gear. Remove the finger and the gear is securely supported. Finished gears are removed from the conveyor at any convenient location by the same light finger pressure.

COMPLETE from blank to finished gear EQUIPMENT

We will be glad to have one of our representatives stop in with a complete set of photos and tell you more about this interesting development. Write to:

MICHIGAN TOOL COMPANY 7171 E. McNichols Road Detroit 12, U.S.A.

Gear Blanks Pushed Through Ring Broaches in 6½ Seconds

A low-cost method of producing small toothed parts requiring high accuracy such as gears, ratchets, racks, serrations, toothed clutches and small-diameter splines has been developed by Colonial Broach. The operation consists of pushing the parts through stationary ring broaches. Instrument gears of 15 tooth, ¾-in. pitch diameter, 14½° pressure angle were finish-broached in 6½ sec on a 6-ton, 36-in. stroke press.

Unloading of finished parts is completely automatic in that the finished gears drop out into the chute at the completion of the cutting stroke. Loading is also simple, the part being placed in a recess in a slide and the slide then being manually pushed into position below the ram of the press. The gear blank is supported in the slide by spring-loaded wedges. As the ram moves down, the arbor enters the bore of the gear blank to align it concentrically.

Shoulders on the push rod contact the side face of the blank, and force it downward through the broaching rings. As soon as the ram has started the broaching stroke, the loading slide can be retracted and reloaded with the next blank.

Colonial Broach Co., Detroit, Mich.
(MORE DATA? CIRCLE FYI 45, p. 163)

Carpenter Stainless-Steel Tube Takes Severe Cold Forming

A stainless steel that work-hardens much slower than conventional chrome-nickel steels is now available in tubing form. Carpenter No. 10 is for applications requiring severe deforming, bending, or upsetting.

Type analysis is carbon 0.08 max., chromium 16, and nickel 18. The tubing is intended to overcome the manufacturing difficulties associated with the rapid work-hardening of conventional 18-8 stainless steels. The slow rate of cold workability of No. 10 is shown by the following tensile strengths after a 50% reduction:

No. 10	146,000 psi
Type 305	165,000
Type 304	170,000
Type 302	190,000

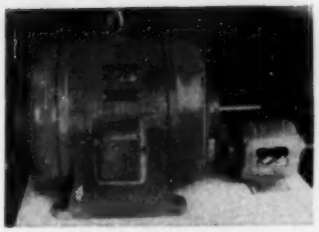
No. 10 can be brazed or soldered after cold working. It is useful for parts that must remain non-magnetic after severe cold working, since its permeability is approximately 1.002 after a 50% reduction with a field of 200 Oersteds, and about 1.018 after an 80% reduction.

The high-pressure container illustrated is spun from No. 10, which is well adapted to spinning operations. It would be extremely difficult to make the tank with closed ends from other stainless alloys.

Corrosion resistance is slightly better than Types 304 and 305. It resists a wide variety of organic and inorganic chemicals and foodstuffs. It will resist nitric acid well and sulphuric acid moderately, but will not resist halogen acids.

Round tubes are available in all sizes and standard gages up to 1⅝ OD and shapes whose equivalent round will not exceed 1⅜ OD.

The Carpenter Steel Co., Alloy Tube Div., Union, N. J.
(MORE DATA? CIRCLE FYI 46, p. 163)



Motor Has Winding on Stator For Quick Stopping

Induction motor employs in addition to the running winding on the stator a single phase ac winding for electro-dynamic braking. The motor is started as any other standard motor, but when it is to be stopped the circuit to the running winding is disconnected, and a circuit is completed between the power source and the braking winding. Under influence of the winding, a retarding force several times that of full-load torque is applied to the rotor.

As the motor approaches a complete stop, the braking force becomes negligible, thereby permitting shifting of gears, turning by hand, or position stopping. Furthermore, there is no reverse torque tending to rotate the load in the reverse direction, which is often the case when "plugging" to a stop.

Standard Dayton Corp., P. O. Box 1001, Dayton 1, Ohio
(MORE DATA? CIRCLE FYI 47, p. 163)

Conveyor With Mesh Belt Handles Hot Forgings

Portable Power Belt Conveyor handles hot or cold forgings weighing up to 25 lb between operations. The cleated wire-mesh belt is available in 8-, 12-, or 16-in. width and 4-, 6-, and 8-ft lengths. The 1/3-hp motor of the Forge Press Veyor is mounted above the belt delivery end for freedom from dirt and scale.

Rapids-Standard Co. Inc., Dept. FPV, 342 Rapistan Bldg., Grand Rapids 2, Mich.
(MORE DATA? CIRCLE FYI 48, p. 163)

FYI

FOR YOUR INFORMATION

FREE details about new machines & tools
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FYI—these initials symbolize information that's important. We use them, too, to head our expanded reader service. Here are two postcards which will bring you new literature, bulletins on new equipment, materials or parts, further information from any advertiser, or advice from editors—for a 3-cent stamp.

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NEW BULLETINS

MACHINES AND ATTACHMENTS

1 LATHES—*Bullard Co., Bridgeport 2, Conn.* 12-page illustrated booklet describes Mult-Au-Matics, vertical turret and horizontal lathes, and semi-automatic work tables. Sizes, capacities, and machine characteristics are included.

2 DISK GRINDERS—*Mattison Machine Works, Rockford, Ill.* 12-page booklet gives details on single-spindle disk grinders. Hydraulically operated, hand-operated, and lever-feed table models are covered.

3 ARBORS & ADAPTERS—*Scully-Jones Co., Chicago 8, Ill.* 14-page catalog contains information on milling-machine arbors, adapters, cutter-chuck adapters, and sleeves; arbor bearing sleeves, spacing collars, and nuts. Drawings of different arbor styles and part specifications and prices are included.

4 MOLDERS—*Fellows Gear Shaper Co., Springfield, Vt.* 4-page circular describes and illustrates high-speed injection molding machines for plastics.

5 *PRESSES — Sales Service Machine Tool Co., St. Paul 4, Minn.* 2-page bulletin contains information and specifications on an open-back, inclinable power press with built-in tie rods.

TOOLS AND ACCESSORIES

6 GRINDERS & BUFFERS—*Cincinnati Electrical Tool Co., Cincinnati 2, Ohio.* 48-page illustrated catalog 31 gives specifications and completely describes a line of electrical tools, grinders, buffers, sanders, drills, lathes, and Air Master dust collectors.

7 PUNCHES—*Whitman & Barnes, Plymouth, Mich.* 42-page catalog 103 lists and illustrates Hercules interchangeable punches, retainers, and die buttons.

8 GRINDER-MILLERS — *Precise Products Co., Racine 8, Wis.* 8-page booklet covers two models of grinder-millers and

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their mounts. Photographs of the machine in operation are included. Specifications are listed.

9 TAPS—*Pratt & Whitney, West Hartford 1, Conn.* 12-page booklet shows taps in operation, and presents examples of thread-cutting from industry.

10 SNAGGING WHEELS—*Mid-West Abrasive Co., Rochester, Pa.* 4-page folder describes and illustrates a snagging wheel with a fiber center.

11 FLEXIBLE SHAFTING — *Elliot Mfg. Co., Binghamton, N. Y.* 4-page bulletin contains drawings of shafts, specifications, and a selection chart for power-drive cores.

12 TOOL POST — *Marnet Machine Works, San Francisco 3, Calif.* 4-page bulletin illustrates a toolpost and toolholder combination while performing. Specifications for the different models are included.

13 CUTTERS—*Goddard & Goddard Co., Co., Detroit 23, Mich.* 8-page booklet describes and illustrates carbide-inserted milling cutters. Shank-end, face- and shell-end cutters for milling cast iron, steel, and non-ferrous materials are included in the specifications.

14 AIR GAGES — *Taft-Pierce Mfg. Co., Woonsocket, R. I.* 16-page catalog 610 describes the applications of the Comparator air gage, and gives specifications of accessories. Profusely illustrated.

15 CHUCKS—*Scully-Jones & Co., Chicago 8, Ill.* 8-page illustrated bulletin covers a line of drill and tap chucks. Specifications and price lists are included.

HEATING AND WELDING EQUIPMENT

16 THERMOMETERS — *Bristol Co., Waterbury 20, Conn.* 44-page bulletin covers company's line of Series 500 thermometers. Liquid-filled, vapor-pressure, and gas-filled types are described in models for recording, indicating, controlling, and telemetering of temperatures.

17 HEAT TREATERS—*Ipsen Industries, Inc., Rockford, Ill.* 4-page bulletin illustrates and describes the T-250 heat-treater. It is a fully automatic, sealed, atmosphere-controlled unit.

PLANT SERVICE EQUIPMENT

18 GEAR REDUCERS—*De Laval Steam Turbine Co., Trenton 2, N. J.* 28-page bulletin H-HS describes different styles and models of herringbone gear reducers, contains load-classification tables, horsepower rating, and dimensions.

19 D-C GENERATORS—*Electric Products Co., Cleveland 12, Ohio.* 4-page bulletin 41-200 contains descriptions of major construction features of company's line of dc generators. Each part or motor is illustrated.

20 COMPRESSED AIR POWER—*Compressed Air and Gas Institute, Cleveland 13, Ohio.* 18-page booklet gives basic reference data on compressed-air and gas power. Divided into three sections: Uses of compressed air, theory of compressed air and types of compressors.

21 RACKS—*Unistrut Products Co., Chicago 7, Ill.* 24-page catalog 600 illustrates and describes metal storage racks. Shows typical rack applications and contains drawings of Unistrut channels and fittings.

22 MARKERS—*Marhem Machine Co., Keene, N. H.* 6-page folder describes a line of standard marking machines and accessories designed to meet all kinds of marking requirements. Illustrations show machines and typical imprinted products.

PARTS AND MATERIALS

23 BEARINGS—*Orange Roller Bearing Co., Inc., Orange, N. J.* 4-page folder shows features of company's line of journal roller bearings. Prices and specifications are included.

24 MOTORS—*Bodine Electric Co., Chicago 12, Ill.* 29-page catalog contains general information on fractional-horsepower motors. Drawings, specifications, and prices are included.

25 RIVETS—*Chicago Rivet & Machine Co., Bellwood, Ill.* 12-page booklet describes and illustrates various models of rivet setters. Rivets such as tubular, split, and shoulder are also shown. Contains two pages of engineering information.

26 VALVES — *Skinner Electric Valve Div., Skinner Chuck Co., Norwalk, Conn.* 6-page bulletin 505 shows drawings and gives specifications on the V-5, M-2, and the M-3 series of solenoid valves.

27 V-DRIVES — *Mauray Mfg. Corp., Chicago 16, Ill.* 16-page illustrated bulletin MVD-1000 contains information on sheaves and multiple V-drives and belts. Specifications for both standard and made-to-order units are given.

28 INCONEL—*International Nickel Co., Inc., New York 5, N. Y.* 24-page bulletin T-7 contains engineering information on the properties of Inconel and Inconel X. Tables and charts show compositions, working instructions, magnetic and strength characteristics, and other information of a technical nature.

29 LUBRICANTS — *Acheson Colloids Corp., Port Huron, Mich.* 6-page bulletin 426 is concerned with the properties of colloidal graphite in metalworking operations. Instructions are given for the use of Aquadag, Oildag, and Glydag for piercing, broaching, die casting, deep drawing, and many other uses.

30 FLAT STOCK—*L. S. Starrett Co., Athol, Mass.* 4-page bulletin 1103 lists Starrett precision ground flat and die stock. Information on structure and analysis, heat-treating, and tempering is also presented.

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There is nothing like this revolutionary Wales Fabricator. It punches, notches and nibbles. Wales exclusive Hydra-New-Matic Drive is unique in its simplicity of design and operation . . . so unique, in fact, the vibration and noise is practically eliminated at 165 strokes a minute. This drive, plus Wales patented "Quick-Change" System makes possible startling "never-heard-of-before" time study figures.

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Specialists in Punching and Notching Equipment

Yale & Towne Fork Truck Designed for Plant Yards

The Yard King pneumatic-tired fork lift truck is for use on rough terrain at the plant. The gas truck has an inclined kingpin to provide easy steering and protect the steering gear against road shock. Operating and steering connections on the undercarriage are cadmium plated to reduce damage from rust and corrosion. A Chrysler fluid-drive and clutch assembly is provided.

Collapsed mast height is 85 in. and stacking height is 118 to 124 in. depending on load capacity of the truck. Speed is governor-controlled to 13 mph.

Yale & Towne Mfg. Co., Roosevelt Blvd., Philadelphia 15, Pa.

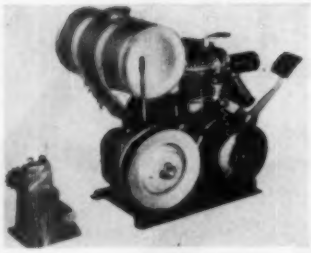
(MORE DATA? CIRCLE FYI 62, p. 163)

Micrometer Measurements Read at Window on Thimble

Measurements are determined on a Read-Rite micrometer through numbers which automatically appear in the window on the thimble, eliminating the computations usually required in taking a micrometer reading. This reputedly makes for easier, faster measuring, and helps avoid costly mistakes from errors in taking micrometer readings. The Read-Rite micrometer is availaable with polished or black-enamel frames.

Central Tool Co., Cranston, R. I.

(MORE DATA? CIRCLE FYI 63, p. 163)



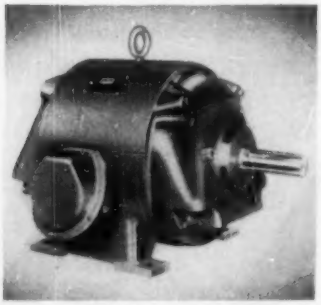
Varimatic Transmission Provides Throttle Controlled Speed Changes

Cushman Varimatic transmission provides, through an automatic clutch, a throttle-controlled speed change varying between a 3:1 reduction in low to a 0.95:1 overdrive in high. Two main units consist of a drive member, which includes the clutch mounted on the engine crankshaft, and connected to it by a V-belt, a driven member mounted on a jack shaft.

A sliding gear transmission is for an additional low speed of 2.25:1 and reverse. The two units are balanced to function together with a belt tension controlled by the action of springs on a cam surface in the driven member. Power unit is particularly suitable for use in material-handling equipment, and vehicles where smoothness of power engagement is necessary.

Cushman Motor Works, Inc., Lincoln, Neb.

(MORE DATA? CIRCLE FYI 64, p. 163)

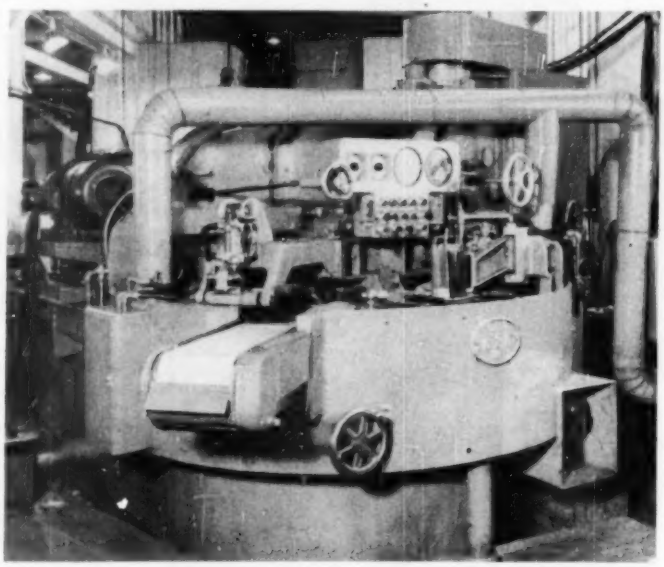


Westinghouse Induction Motors Have Splashproof Baffles

Splashproof type CSP Life-Line induction motors are now available from 7½ to 100 hp. The squirrel-cage motors for constant-speed applications are protected from dripping or splashing liquids by solid rolled-steel frames and baffles in the end brackets.

Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

(MORE DATA? CIRCLE FYI 65, p. 163)



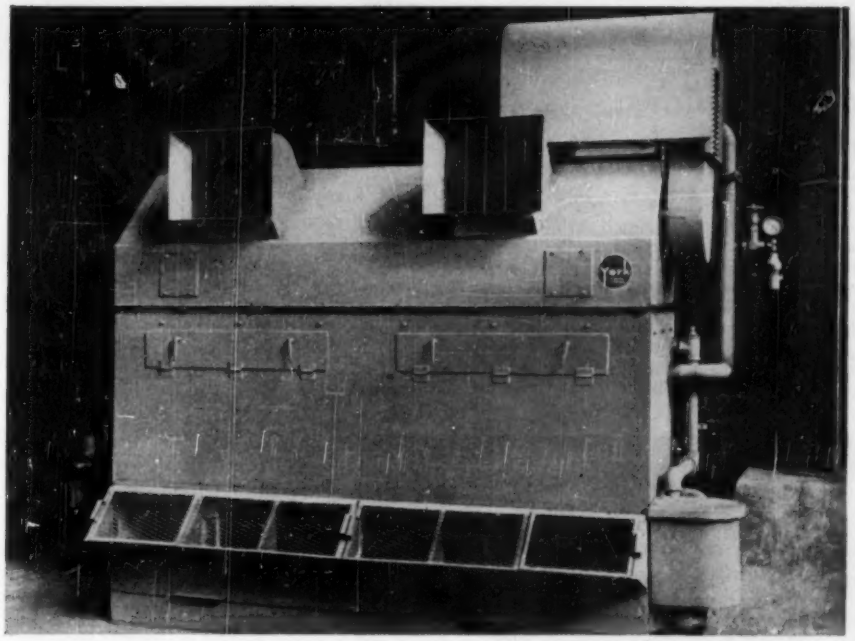
SERRATOR GRINDER Model 224 produces serrated sections and ledger plates for farm implements. Two single-spindle grinder heads progressively bevel and serrate the units. The ribbed serrating wheel is crush-dressed by a roll with motor drive synchronized with the abrasive wheel. The wheel is dressed at pre-determined intervals without requiring any decrease in wheel speed.—*Charles H. Besly & Co., Beloit, Wis.*

(MORE DATA? CIRCLE FYI 66, p. 163)

TO OWNERS OF AIR CONDITIONING AND REFRIGERATION EQUIPMENT . . .

Worried Over Water

The York Water Economizer, equipped with Revere Copper and Brass Fittings to guard against corrosion and assure trouble-free operation, will save you up to 95% on water.



FOR many years Revere has furnished the York Corporation, York, Pa., with copper and brass for use in its air conditioning, refrigeration and heating equipment. Engineers at York tell us that during that time they have learned to depend on Revere Products for high quality and uniformity of metal, correct temper, and strict adherence to specifications.

It was this satisfaction with Revere over the years that led York engineers to specify Revere Products for the York Water Economizer. The brass spray nozzles and copper water and refrigeration tube with which this unit is equipped assure constant, trouble-free protection against that efficiency-destroyer which is ever-present when water and metals get together . . . corrosion.

This is a mighty important thing for York, and a mighty important thing for present and prospective owners of air conditioning and refrigeration equipment. The York Economizer itself is a mighty important unit right now, too. For, with water a most critical item in many sections of the country, both from the standpoint of supply and disposal facilities, the York Water Economizer makes it possible to save up to 95% of the amount of water normally required. On a typical installation of 100 tons of refrigeration capacity, for example, 17,100 gals. of water can be saved every hour of operation!

York also uses Revere Copper and Brass products in its water coolers, for cooling coils, chilled water piping, and other component parts of its air conditioning systems.

Perhaps there is a Revere Metal or alloy that you can use to advantage in your product. Why not call the nearest Revere Sales Office and see?

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

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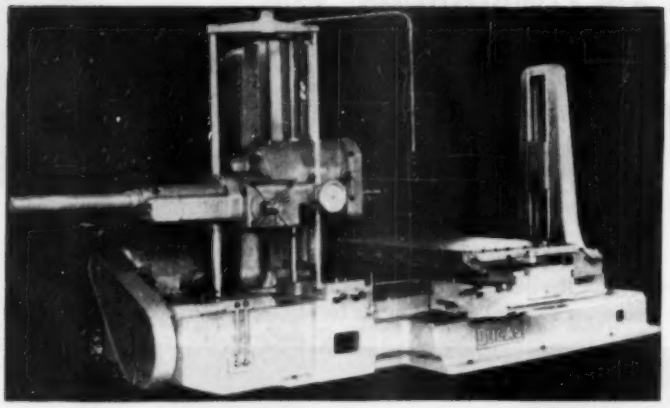
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.



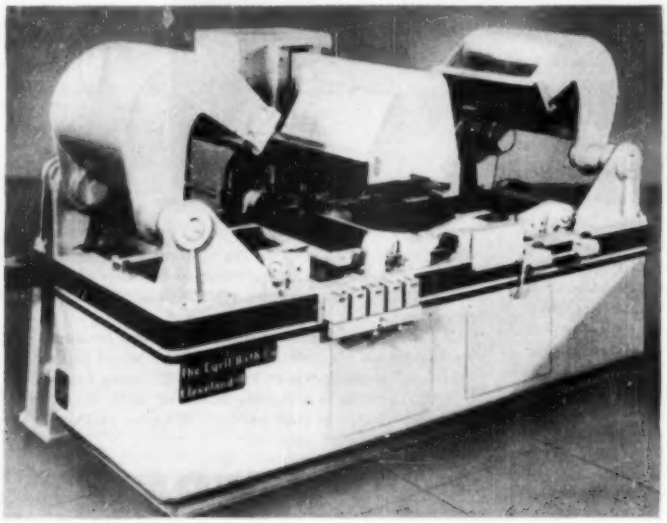
New Britain Redesigns Lucas Horizontal Boring Machine

The bed of the Model 42 B-60 4-in. horizontal boring machine has been extended to support the motor and speed and feed gear boxes. Number and size of control handles has been reduced and each one has been color coded. Feed unit selecting levers indicating direction of feed and feeds can be combined.

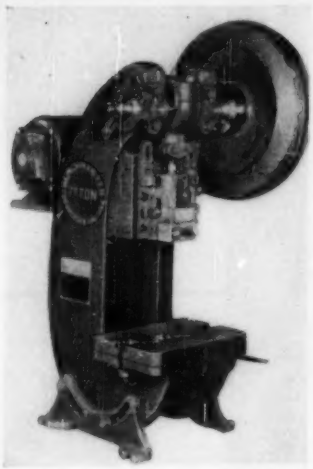
Spindle of this machine is mounted on anti-friction taper roller bearings and is driven at high speed range by V-belt drive. Large double gear mounted on the spindle sleeve which is the drive for the two lower speed ranges is out of mesh in the high speed range and acts as a flywheel to dampen vibration.

Automatic power positioning control allows operator to set up and run through a complete production job by merely inserting master rods and then through regular operating controls, get exact settings without hand adjustment for each subsequent operation. Costly jigs or fixtures are eliminated. The machine is built in 3-, 4-, 5-, and 6-in. spindle sizes, with a variety of heights, column lengths of bed and lengths and widths of table. Three larger models are available in electrically controlled machines whereby all motions of every unit are controlled remotely from a separate positionable pendant.

The New Britain Machine Co., Lucas Machine Div., Cleveland, Ohio
(MORE DATA? CIRCLE FYI 68, p. 163)



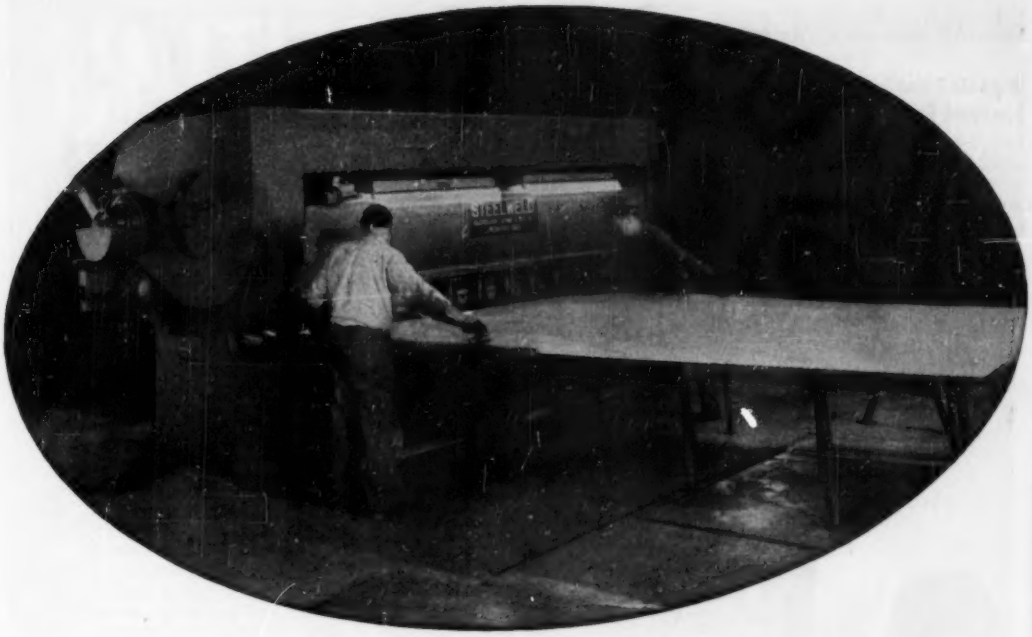
FOUR-WING TANGENT BENDER forms 125 washing machine cases per hr. Blanked and punched sheets are fed end-wise into a clear space in the center of the machine. Series of 15 movements can be manually controlled but is normally automatic. The unit is 10 ft. 6 in. right to left, 8 ft. 4 in. front to back and 6 ft. high. An overhead arm can be bolted in place to provide welding devices so that the entire case can be formed from a flat sheet welded while in the machine—*The Cyril Bath Co., Cleveland, Ohio* (MORE DATA? CIRCLE FYI 67, p. 163)



Benchmaster Press Put Out In 7½-Ton Model

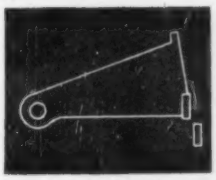
To cover the widest possible range of press uses, the shut height of this 7½-ton punch press (ram up, to bed) has been increased to 9 in. Oversize die capacity does not hamper use of standard size die sets, but gives almost 200% more vertical die space. This extra capacity also aids adaptations of roll and hopper feeding devices and eases many tricky operations at high production rates. Extra-long slides on the ram insure accurate stroke and both ram slides and ball joint are simultaneously lubricated by a one-shot system. Throat depth from ram centerline to frame is 4 in. and throat width between columns is 5 in. Bolster plate is 1 x 8 x 11 in., bed opening 4 x 5 in., and ram bore 1 9/16 in. Standard stroke is 1¼ in. Strokes up to 2½ in. are available. The unit does 200 strokes per min and weighs 380 lb, less motor.

Benchmaster Mfg. Co., 1958 West Pico Blvd., Los Angeles 6, Calif.
(MORE DATA? CIRCLE FYI 69, p. 163)



PIVOTED-BLADE MAKES SHEARING
Fast . . Easy . . Accurate

Because of the pivoted-blade design, Steelweld Shears have several outstanding advantages heretofore unavailable in any shears at any price, which make shearing fast, easy, accurate:



EASY KNIFE ADJUSTMENT

A direct result of this design is the easy knife adjustment it makes possible. Knife clearance is quickly made to suit every plate thickness by simply turning a crank until pointer in an indicator is set for the metal to be cut. No bolts to loosen; no parts to move.

ELECTRIC FOOT CONTROL

This feature eases the operator's work because the foot switch requires practically no effort to operate and can be slid around to wherever most convenient to use. It has been adopted as standard for all Steelweld Shears.

ALL-WELDED ONE-PIECE FRAME

Only because of the pivoted-blade design, was it possible to weld all parts of the frame into one solid integral unit. As there is no need of moving the bed to adjust for knife clearance, it, too, is welded permanently to the end housings. Since there are no bolted connections to loosen and misalign, deflections are minimized and long-time accuracy assured

MANY MORE IMPORTANT FEATURES

These are a few of the features. There are many more. When you get the facts you will agree that no other shears compare with Steelwelds.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1413 EAST 282nd ST. *WICKLIFFE, OHIO*

STEELWELD PIVOTED BLADE SHEARS

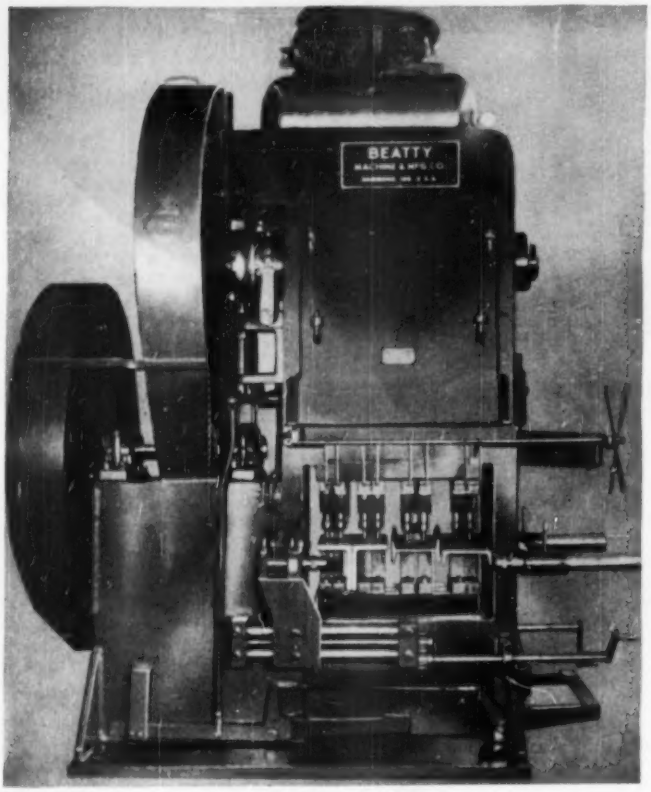
Wipe-On Paint Stick Marks Stamped, Engraved, Etched Parts

Lacquer-Stik is a semi-solidified paint in a stick form, developed for wipe-ons or fill-ins of stamped, engraved, or etched markings and designs on smooth-surface materials. For application, the stick is rubbed over the impression and the surface residue is wiped off. Filled-in markings stand out clearly and the part can be handled immediately.

The imbedded paint hardens quickly and soon becomes permanent. Its chemical composition is such that it expands and contracts with temperature changes of the part and therefore does not loosen or fall out. Filled-in engraved parts can be subjected to temperatures up to 500 F.

Lake Chemical Co., 3052 W. Carroll Ave., Chicago 18, Ill.

(MORE DATA? CIRCLE FYI 70, p. 163)



Guillotine Beam, Shape Punch Provides Adjustable Strippers

Plates or webs of beams, channels, and angles can be punched by this machine. It can also be furnished with special overhung die blocks for punching flanges of small beams and channels.

The machine illustrated is equipped with air-operated clamps against adjustable fixed stops and gag operating levers for machine operation from the right side. Adjustable strippers, jaw clutch with auto stop at the top of stroke, and anti-friction flywheel-shaft bearings are designed into the unit. Punch tools are gagged for selective punching.

Capacity is 200 tons or four 15/16 dia. holes through ¾-in. plate. Stroke is 2½ in. and distance between housing 32 in. Size of the ram (right to left), is 28 in. and (front to back) 13 in. Table is 32x21 in. and die space 26 in.

Beatty Machine & Mfg. Co., Hammond, Ind.

(MORE DATA? CIRCLE FYI 71, p. 163)

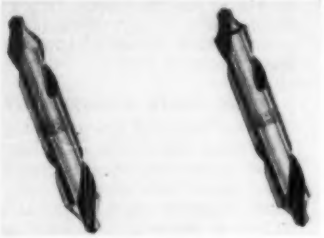
Three-Wheel Fork Truck Turns On a Dime—Almost

Compact design and proper distribution of weight combined with rear-wheel drive allow the JFTT Fork Truck to right-angle stack in narrower aisles than trucks of similar length according to manufacturers. The rear-wheel drive permits the truck to pivot about a point halfway between the two front wheels.

Directionally operated controls for tilting of mast, lifting and lowering of load, and traveling two speeds in each direction are foot-operated. Standard capacities are 1000, 1500, and 2000 lb for loads 32, 40, and 48 in. long. Standard lifting heights on telescopic models are 130, 106, and 82 in. with corresponding collapsed heights of 83, 71, and 59 in.

Lewis-Shepard Products, Inc., 261 Walnut St., Watertown 72, Mass.

(MORE DATA? CIRCLE FYI 72, p. 163)



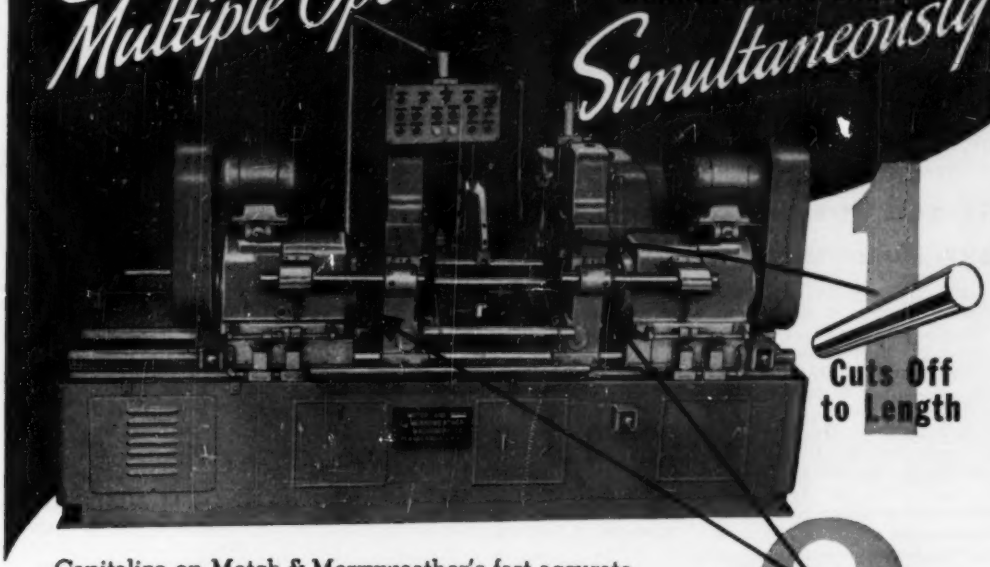
Double-End Tool Combines Drill and Countersink

Greater shear-cutting action of the Chip-Flow double-end combination drill and countersink allows the drill to take chips with greater efficiency and less effort. Balance between a fast spiral and a heavy flute are said to assure rugged strength. The tool is available in two types in a full range of sizes. Type "A" has 60° included angle, and Type "B" provides 60 and 120° included angles.

Cogsdill Twist Drill Co., Detroit, Mich.

(MORE DATA? CIRCLE FYI 73, p. 163)

UNITIZE *Multiple Operations!* CUT OFF TO LENGTH AND MACHINE BOTH ENDS — *Simultaneously*

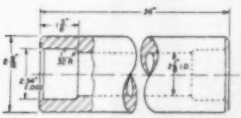


1 Cuts Off to Length

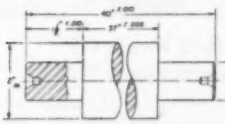
2 Machines Both Ends

Capitalize on Motch & Merryweather's fast accurate circular sawing by combining it with simultaneous double-end machining operations. Save handling and floor space! Increase output and reduce cost! Unitize your production.

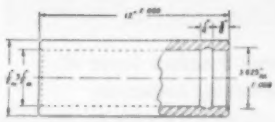
Write for further information.



Operation: Cut off; bore and chamfer inside and outside, both ends.
Material: SAE 1020 steel tubing.
Production: 140 pcs/hr. @ 100% eff.



Operation: Cut off; hollow mill and center drill both ends.
Material: C 1117 cold drawn steel.
Production: 84 pcs/hr. @ 100% eff.



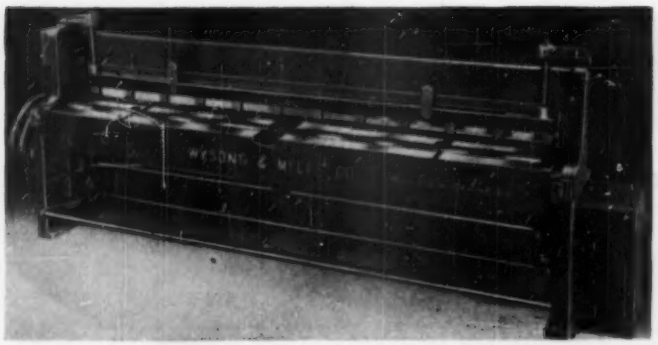
Operation: Cut off; face and chamfer both ends; internal groove one end.
Material: C 1015 seamless steel tubing.
Production: 110 pcs/hr. @ 100% eff.

- Chamfers both ends • Center drills both ends • Center drills and chamfers both ends • Threads both ends
- Turns one or both ends (box tool)
- Chamfers O. D. and I. D. of tubing
- Reams one or both ends of tubing
- Chamfers O. D. and reams both ends of tubing • External grooves and chamfers one or both ends
- Internal grooves, faces and chamfers O. D. and I. D. one or both ends of tubing

Manufactured by

THE MOTCH & MERRYWEATHER MACHINERY COMPANY
715 PENTON BUILDING • CLEVELAND 13, OHIO
Builders of Circular Sawing Equipment, Production Milling, Automatic and Special Machines

PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT



16-Gage Power Squaring Shears Have Automatic Holddown Action

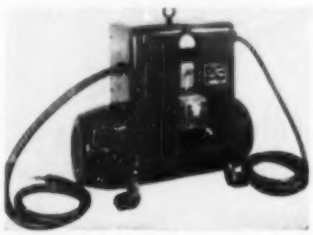
Bed, end-frames, knife bar, holddown, and top girder of this Wysong and Miles power squaring shear line are one-piece high-tensile castings containing more than 30% steel. Cutting lengths include 42, 52, 72, 96 and 120 in.

Bed is squared with the end frames in all three directions to insure accurate cutting and ways for holddown and knife bar travel are machined and hand scraped. Sliding key clutch with spring loaded finger prevents clicking, and a non-repeat unit is built into the clutch which can be set for single stroke or continuous shearing.

Back gage is ball-bearing precision unit which can be handwheel adjusted to 1/128 in. Holddown action is automatic with applied pressure governed by adjustable compression springs.

Wysong and Miles Co., Greensboro, N. C.

(MORE DATA? CIRCLE FYI 74 p. 163)



Single Circuit Unit Charges Industrial Truck Batteries

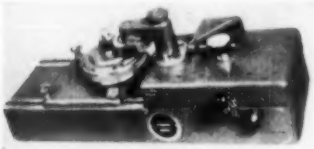
Six-cell lead-acid batteries of up to 300 ampere-hour capacity can be charged by the Model 669-6-1 charger. Built as an integral unit it is 100% automatic in operation and can completely charge batteries in eight hours or less.

To operate, plug is inserted in battery and time-clock switch is moved to "stop." This automatically energizes the magnetic coil of the motor starting switch, starting the charge.

An Exide TVR temperature compensated voltage relay operates when the battery is about 80 to 90% recharged. At 77 F and operating at 2.35 to 2.37 v per cell at the battery terminals, this relay closes applying ac to the time clock motor. The clock is set to its present time—usually three hours. When the clock reaches zero hours it shuts down the set.

Motor Generator Corp., Hobart Square, Troy, Ohio

(MORE DATA? CIRCLE FYI 75 p. 163)



Fixture Broadens Scope of Gear-Rolling Inspection

Manufacturers say the Red Ring rolling fixture facilitates loading and unloading the work gear and enables larger and more complicated assemblies to be checked by this method. Gear rolling indicates any errors in size or eccentricity, and checks for excessive tooth roughness.

Work is held in a pot chuck, with a C-washer and thumb nut to tighten it down. It is carried on an adjustable head at the left end of the fixture to compensate for gears of varying diameters. The master gear, used to check work, is held by a swinging head, mounted on a precision ball-slide carriage (at right). When the carriage is retracted by the lever, the swinging head my be lifted up and swung clear of the work for easy loading and unloading. Inspection is made by advancing the carriage to bring master and work gears into mesh. Gears are held in contact by constant predetermined spring pressure and rolled together. The errors register on dial indicator.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

(MORE DATA? CIRCLE FYI 76 p. 163)

Standard Wrought-Iron Slings Made of ⅜ to 1½ in. Chain

Line of wrought-iron sling chains consists of a wide variety of single, double, three-way and four-way slings of virtually any desired length. Standard slings are made up of ⅜ and 1½ in. chain with larger chain available on special order.

Sling chains are furnished with rings and slip hooks unless otherwise specified. Pear shaped links may be used instead of rings and grab hooks substituted for sling hooks when desired.

The Cleveland Chain & Mfg. Co., Cleveland 5, Ohio

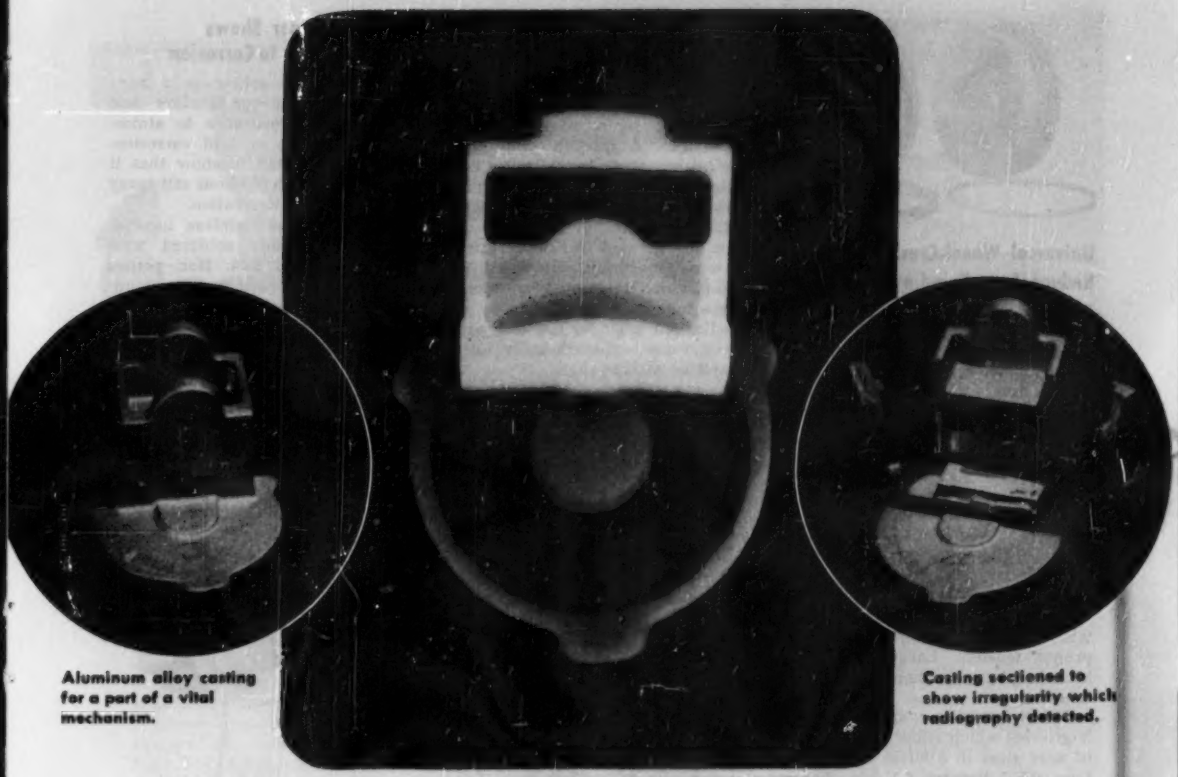
(MORE DATA? CIRCLE FYI 77 p. 163)

Gas Torch Weighs 4 lb Generates Heat to 2000 F

Butane-propane gas torch called the precision torch weighs only 4 lb fully loaded and is capable of generating heat up to 2200 F. The torch is totally self contained in a cylinder 10½ in. high and 2½ in. in diameter. It is designed for light brazing, soft and hard soldering, and a variety of other general heating operations. One filling gives seven hours of continuous operation. Pressure is constant until the torch is empty.

Precision Engineering & Mfg. Co., 274 Center St., Saginaw, Mich.

(MORE DATA? CIRCLE FYI 78 p. 163)



Aluminum alloy casting for a part of a vital mechanism.

Radiograph which revealed imperfection in the casting.

Casting sectioned to show irregularity which radiography detected.

Radiography helps prevent delays in production

ALONG with scores of other castings, this one becomes part of an intricate mechanism. Extremely high quality is a must. Machining is long, complicated, and precise. Should the casting be imperfect, not only the piece and the machining time are lost—the flow of finished parts is disrupted and a whole assembly line delayed.

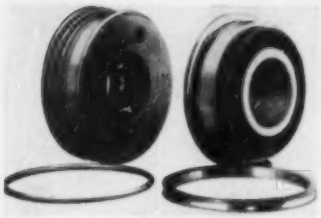
This is why it pays the foundry well to check the casting radiographically. It is the one way any foundry can be certain it releases only sound castings. And, equally important, it is a way that not only detects irregularities but, at the same time, indicates ways to revise gating, venting, pouring temperature, and other variables which influence consistently good work.

Ask your X-ray dealer to explain the many ways radiography can increase your yield and cut your costs.

EASTMAN KODAK COMPANY
X-ray Division • Rochester 4, N. Y.

Radiography...
another function of Photography

Kodak
TRADE-MARK



Universal Wheel-Crusher Rolls Reduce Form-Grinding Costs

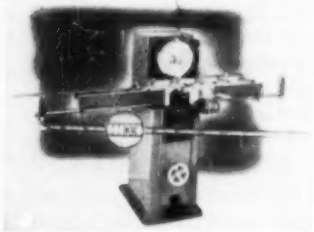
Rolls which permit the shaping of intricate single and multiple forms for grinding tools, dies, and production parts are available to be utilized with standard Jerpbak-Bayless portable, motorized crushers. Shop and toolroom costs are claimed to be reduced, and accuracy is reported to be increased over that which has been possible heretofore.

The No. 1 wheel crusher roll is made up of V-grooves in the periphery in which to mount round wire to produce a convex radius in the grinding wheel. Small wires are held in place by a locking key with which they are tightened to the proper tension. Larger wires are held in place by their own spring tension.

The No. 1 roll has seven annular-V-grooves which allow for mounting of wire sizes in 0.001-in. increments from 0.002 through 0.130-in. diameter with a minimum of 180° protruding above the surface of the roll.

No. 4 Universal square-wire roll is made in the form of a shoulder arbor with a precision collar that holds the square wire in place. A ¼-in. square ring is used in which concave radii are ground to produce convex radii on the grinding wheel.

The Jerpbak-Bayless Co. Inc., Chagrin Falls, Ohio
(MORE DATA? CIRCLE FYI 80, p. 163)



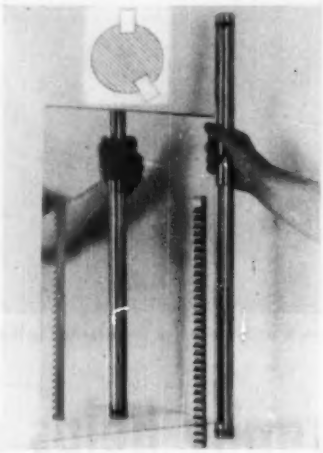
Scale-Marking Machine Produces Sunken Inscriptions

Lineal graduations and numbers are permanently rolled into such articles as typewriter-paper bail bars by the Model 306 scale-marking machine. It can be readily adapted for similar metal marking or on plastics, wood, or other materials.

A steel roll-marking die produces the sunk inscription into the work. The machine will mark lengths up to 3 ft at speeds up to a production of 300 ipm. A relatively low pressure against work is said to be adequate for the marking, thus applying minimum strain with resulting negligible distortion.

An air-operated worktable brings the work into contact with the marking die, which is mounted on a special gearmotor drive on the main die spindle. Air provides marking pressure and depth of mark is controlled by setting the air gage.

The Noble and Westbrook Mfg. Co., East Hartford 8, Conn.
(MORE DATA? CIRCLE FYI 81, p. 163)



Two-Pass Broach Cuts Long and Deep Keyways

Here is a broach which incorporates two slots in the broach body and only one cutting blade. The broach blade is cut on a taper to assure positive cutting action by each tooth. The blade is first inserted in the deepest slot and the broach is passed through the work. Then the blade is inserted in the second slot and the broach is passed through the work again to finish the keyway to an accuracy of 0.0005-in.

This tool is available in a complete range of sizes for special or production keyway cutting. Broach shown is capable of cutting a keyway ½ in. wide, 5/16 in. deep, and 3 in. long in cast iron, mild steel, alloy steel, malleable iron, aluminum, brass, and similar materials. Only 2 to 4 tons pressure is required.

The Kase Machine Co., 18422 Buffalo Ave., Cleveland 19, Ohio
(MORE DATA? CIRCLE FYI 82, p. 163)

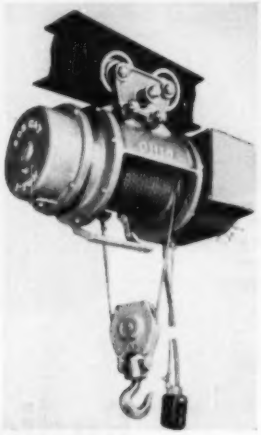
All-Metal Solder Shows High Resistance to Corrosion

Farco all-metal solder is a non-reactive metallic combination said to show high resistance to atmospheric, alkaline, or acid corrosion. Tests are reported to show that it will withstand an 800-hour salt-spray bath without deterioration.

Metals such as stainless, inconel, monel are readily soldered with ASMC all-metal flux. Non-porous water-tight joints are made in aluminum. It can be extruded in ⅛-in. wire and wound on spools.

Farco solder is $2 per lb in 1-lb spools FOB Philadelphia.

Farrelloy Co., 1217 North 26th St., Philadelphia 21, Pa.
(MORE DATA? CIRCLE FYI 83, p. 163)



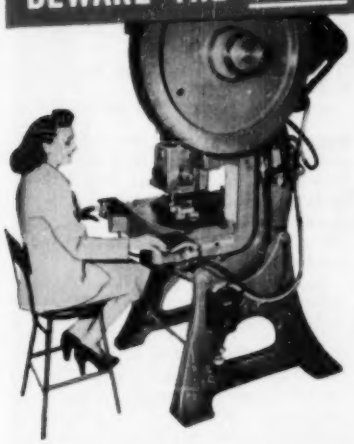
Over-all Size Reduced On Electric Cable Hoists

Heavy-duty electric cable hoists range in lifting capacity from ½ to 5 tons. The motor of the Bob-Cat hoist is totally enclosed within the cable drum, reducing over-all dimensions and cutting weight. The motor is fully protected against weather, moisture, dust and corrosive atmospheres. Load-sustaining parts are made from steel forgings and castings which give the hoist a factor of safety of over 6 to 1.

The load hook oscillates and swivels on roller bearings and is suspended on a 5/16-in. preformed plow-steel cable that can be replaced without disassembling any part of the hoist. Designed for operation on 220, 380, 440 or 550 v, 3-phase, 60 cycle current, the Bob-Cat hoist is furnished with either rope or push-button control on pendant cable.

The Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland 4, Ohio
(MORE DATA? CIRCLE FYI 84, p. 163)

BEWARE THE THREE O'CLOCK LET-DOWN



or work and workers may suffer

How are your presses, shears, brakes and similar machines operated? With clumsy, hard-to-push foot pedals? You'll never beat the Three O'Clock Let-down that way, and the consequences may be more serious than you think.

Day-long pedal pushing is extremely tiring. Along about three o'clock, after a tough day, it takes its toll. Production slows down. A worker's alertness is dulled. Hands get careless. Conditions for an accident are ripe.

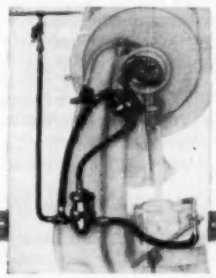
You can get a better day's work, a bigger day's work, a safer day's work with Schrader Hand-operated Pneumatic Press Controls. They're designed specifically to keep both hands out of the danger zone. They're designed for the utmost ease of operation. Because they're safer, employees work relaxed. Because they're easier to use, employees get more work done and still feel fresher at quitting time.

Schrader Hand-operated Pneumatic Press Controls are better than ever now—equipped with the new Schrader Cutout Valve, the new Schrader Air Line Filter, and your choice of hand valve guards. Available in complete, and surprisingly inexpensive, sets.

Schrader Pneumatic Controls may also be obtained in complete sets for foot operation, or for combined hand-and-foot operation.

Write for complete information today!

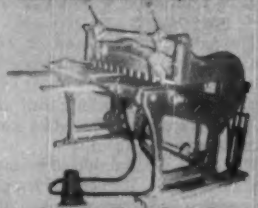
You can get MORE WORK and SAFER OPERATION from old (or new) Presses



A few dollars for a Schrader Air Ejection Set, and a few hours for installation, will give your presses new life and improve their safety as well. Complete sets for cam operation (as shown) or for ram operation. With Pilot Valve for timing the air blast (as shown) or without.

More Work, Less Spoilage with Foot Press Controls

Schrader Foot Press Controls eliminate fatigue, increase production. There's less spoilage because there is uniform pressure in each stroke. Use hand-operated set shown for maximum safety. Also complete sets for foot or combined hand-and-foot operation.



Schrader Shear Control

Eliminates awkward and tiring foot leverage. One man can now position the work and work the shear. Extra force enables one man to shear heavier gauge metals. Pedal is portable.

Eject Heavy Parts with New Schrader Cylinder Knockout Set

This new set was designed to eject parts too heavy to be removed by air blast. Timed to eject work with each cycle of the press.

HUNDREDS MORE PRODUCTS FOR EFFICIENT AIR CONTROL Air Cylinders, Blow Guns, Filters, Gauges, Hose, Hose Reels, Lubricators, Pilot Valves, Pressure Regulators, Quick Acting Couplers, Rotating Pressure Joints, Unifiare fittings, and Valves. Hydraulic Gauges.

MAIL THIS COUPON TODAY

A. SCHRADER'S SON, 490 Vanderbilt Ave.
Brooklyn 17, N.Y.
Division of Scovill Manufacturing Company, Incorporated

Please send me information and free literature about the products I have checked in the squares at the right.

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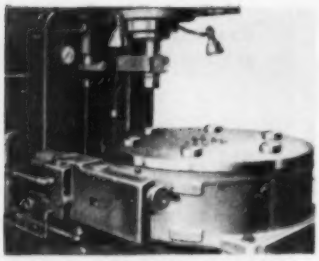
Schrader PRODUCTS CONTROL THE AIR

Check Here	
	Air Cylinders
	Operating Valves
	Press & Shear Controls
	Air Ejection Sets
	Blow Guns
	Air Line Couplers
	Air Hose & Fittings
	Hose Reels
	Hydraulic Gauges
	Pressure Regulators & Oilers
	Air Strainers
	Unifiare Tube Fittings



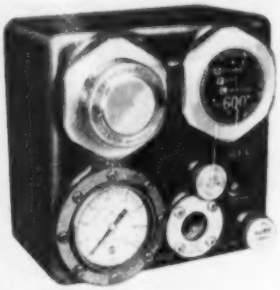
High Speed, Versatility Combined In 33-In. Hydraulic Index Table

Hydraulically powered 33-in. automatic index table has 24-in. work circle and provides variable speeds for any pre-selected indexing rate from 10 to 70 indexes per minute. Dial is positioned with an accuracy of ± 0.002 in.

The table can be used on either the Denison 25-ton Multipress or other makes of equipment. It can be powered by the pumping unit of the press or it can be operated by a small auxiliary pumping unit.

The table is available in 6- and 12-station models. It operates from and in position sequence with the action of the press ram through the control system of the hydraulic power unit. The ram cannot descend while the table is in motion, and the table will not rotate until the ram has completed its cycle. A positive locking device holds the dial in place at each station. A built-in "skip station" accessory is available which permits hurdling from one to five stations without loss of time at each idle station.

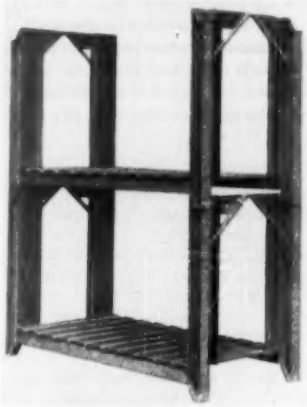
The Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio
(MORE DATA? CIRCLE FYI 85 p. 163)



Logansport Air Filter Lubricator Now Has Piston Regulator

The R-F-L unit now incorporates piston-type instead of bellows-type regulator, and the synthetic filtering element takes the place of the former porous-metal air filter. The filter cover and regulating valve are screwed into the main body of the unit. The R-F-L unit is a casting measuring 6 in. square by 4¾ in. deep. It is installed in the air intake line from the main air line, and can be mounted on a central control panel. Its functions are to regulate air pressure providing smooth, full, uniform action; filter air, and lubricate the air to minimize wear on working parts.

Logansport Machine Co., Logansport, Ind.
(MORE DATA? CIRCLE FYI 86 p. 163)



Safety Interlocking Designed Into Welded Stacking Racks

Interlocking ends on all steel stacking racks prevent shifting. Of welded construction with corrugated bottom and I-beam ends the racks are built to any size to fit specifications. Racks are said to be ideal for stacking wire or similar materials where headroom is a critical factor.

The Palmer-Shile Co., 16019 Fullerton, Detroit 27, Mich.
(MORE DATA? CIRCLE FYI 87 p. 163)

EutecRod 155 has a bonding temperature of just 700 F and is for soldering both ferrous and non-ferrous metals. It has a tensile strength about half way between that of soft and silver solders, better corrosion resistance than soft solders, and excellent wetting properties. Sizes available are 1/16, 3/32, and 1/18 in.

Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.
(MORE DATA? CIRCLE FYI 88 p. 163)

Casting compound that is neither a metal nor a plastic displays qualities of both. Plasti-Metl is the color of copper, harder than some casting metals, but can be poured into molds at room temperature. With the aid of varying amounts of a catalyst, it can be made to set at room temperature without heat, or in an oven at low temperatures, forming a hard, tough, metallic-appearing casting that can be machined or polished with ordinary tools.

The Lockrey Co., College Point 3, N. Y.
(MORE DATA? CIRCLE FYI 89 p. 163)

Reverse-polarity d-c arc-welding electrode is available in 5/32- and 3/16-in. dia for field trial. The W-52 carbon-molybdenum electrode is designed for high-quality welding of low-alloy, high-tensile steels, such as pipelines.

General Electric, 1 River Road, Schenectady 5, N. Y.
(MORE DATA? CIRCLE FYI 90 p. 163)

Electronic timer Series 30 is recommended for process control and machine timing when long life, repeat-cycle operation, or precise accuracy is desired. It can be used to control such automatic equipment as drilling machines, automatic filling machines, photographic printers, spot welders, grinders, and honing machines. The unit operates on 115 or 230 v, 50/60-c supply. Net weight is 8 pounds.

Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass.
(MORE DATA? CIRCLE FYI 91 p. 163)

Low hydrogen Tensilend welding electrodes are said to simplify fabrication by elimination of preheat in welding low alloy high-strength steels in the 70,000-, 100,000-, and 120,000-psi tensile class. Tensilend 70, for welding steels in the 70,000 psi class, is believed to have the broadest field application. With stainless coating and high tensile weld deposit, it can be used both for welding low-alloy high-strength steels and also for welding mild steels under highly restrained conditions, high carbon steels, and sulphur bearing free machining steels. The electrodes have a quiet arc and low spatter loss.

Arcos Co., 1500 So. 50th St., Philadelphia 43, Pa.
(MORE DATA? CIRCLE FYI 92 p. 163)

Adamas Grade D tungsten carbide, for steel cutting tools, is reported to give uniformly high and consistent performance. Designed for general purpose machining of steel, it can be used on interrupted and roughing cuts. Good edge wear combined with toughness is said to give it a wide range of applications. Free tips are offered for use on difficult jobs for comparative trials.

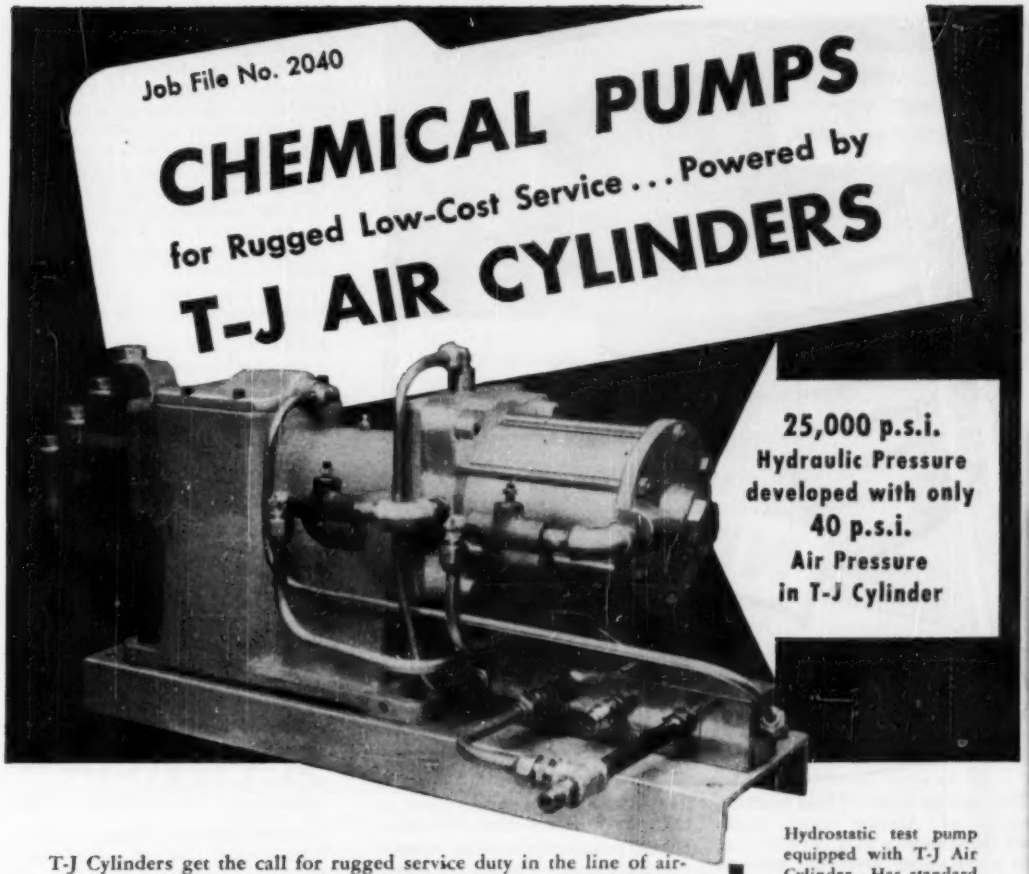
Adamas Carbide Corp., 1000 So. 4th St., Harrison, N. J.
(MORE DATA? CIRCLE FYI 93 p. 163)

Job File No. 2040

CHEMICAL PUMPS

for Rugged Low-Cost Service . . . Powered by

T-J AIR CYLINDERS



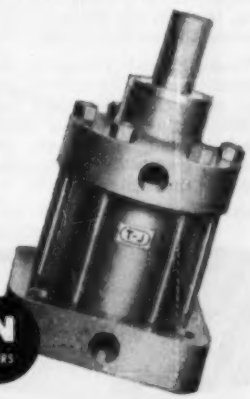
25,000 p.s.i.
Hydraulic Pressure developed with only 40 p.s.i.
Air Pressure in T-J Cylinder

T-J Cylinders get the call for rugged service duty in the line of air-powered Chemical Pumps manufactured by Milton Roy Co., Philadelphia. These are controlled volume pumps designed for positive displacement metering with double-ball check liquid ends.

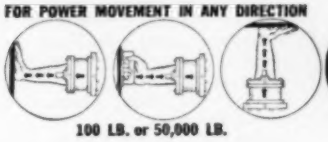
The pumps employ T-J double acting steel air cylinders, bored and honed to accurate concentricity. Both cylinders and piston rods are hard chrome plated to protect against wear and rust. Piston packing is self-sealing, eliminating adjustable glands. Pistons are box type, equipped with two cast iron piston rings with a neoprene "O" ring between them. This construction (standard with T-J Cylinders) assures maximum effective use of compressed air and long maintenance-free service.

Consult with T-J about your problems in power movement—pushing, pulling or lifting. These are jobs for T-J Air and Hydraulic Cylinders to *save labor* and *cut costs.* Many standard sizes and styles . . . both cushioned and non-cushioned types . . . 100 lb. or 50,000 lb. Precision-built, dependable. Write for additional information. The Tomkins-Johnson Co., Jackson, Mich.

Hydrostatic test pump equipped with T-J Air Cylinder. Has standard liquid ends for pressures up to 25,000 p.s.i. By balancing air input pressure against desired hydraulic pressure, the system is fully automatic . . . simple, safe and low cost.



FOR POWER MOVEMENT IN ANY DIRECTION



100 LB. or 50,000 LB.

33 YEARS EXPERIENCE

TOMKINS-JOHNSON

RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

T-J

ALLEN TRU-ROUND DRYSEAL PIPE PLUGS

100% Pressur-Formd

This newest Allen ○ Head product, made of Allenoy steel, meets all the demands of a dryseal plug in applications involving extreme pressure, such as in refrigeration and hydraulic equipment. For use with dryseal taps. No sealing compound required.

It stands up under repeated wrenching as no plug has before. Its Pressur-Formd socket, unweakened by drilling and broaching, is so strong the key will shear before the socket strips.

Pressur-Formd threading insures metal-to-metal contact all the way by producing burnished threads. This method prevents distortion and nicked, imperfect threads which gouge softer metals and impair the seal.

Accurate fit is assured by 360° roundness, and by a perfect taper, at both the pitch and crest diameters.

Here's positive protection against the high cost of leaky or faulty pipe plugs. Get "Tru-Round" Dryseal Pipe Plugs by ordering genuine Allens in the distinctive black and silver box.

Now available in sizes from 1/16" to 1¼". No increase in price. Write us for samples and engineering data.

FOR NORMAL APPLICATIONS

Our "Tru-Round" standard pipe plug, also Pressur-Formd, is leakproof, and a sealing compound is not ordinarily needed for pressure-tight joints. Precise roundness and smoother threads make for better seal. Threaded strictly in accordance with Army-Navy Aeronautical Specification AN-P-363. Fully guaranteed.

ALLEN ALLEN HEAD

MANUFACTURING COMPANY

Hartford 2, Connecticut, U. S. A.

NEW YORK, CLEVELAND, DETROIT, CHICAGO, LOS ANGELES

ALLEN ..... FOR 40 YEARS THE BUY-WORD FOR SOCKET SCREWS

Dial center finder is a rigidly constructed yet sensitive indicator for locating work pieces on jig borers, milling machines, radial drills, or lathes. It can be used to indicate external such as toolmaker's buttons or to indicate from a hole in the work by removing the feeler rod assembly. The point on the center spindle can be used to indicate from a prick punch mark or drilled center, making it ideal for face-plate or chuck work on a lathe.

Waltham Dial Gage Co., Stow, Mass.
(MORE DATA? CIRCLE FYI 94, p. 163)

E-Z-Go di-phase cream hand cleaner is reported to thoroughly remove industrial hand soil, with or without water. It contains scientifically formulated chemicals, including "Hand-Sept" (special antiseptics) and lanolin. This cleaner discourages dermatitis and soothes and aids chapped hands, cuts, and scratches.

Amaza Laboratories, Box 4114, Cleveland 23, Ohio
(MORE DATA? CIRCLE FYI 95, p. 163)

Easy-Flo 45, a silver alloy for brazing ferrous, non-ferrous, and dissimilar metals is now put out in 5-oz packets. These packets contain a coil of 1/16-in. wire (approximately 330 lineal inches), instructions for use, and a folder giving complete details about the product.

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
(MORE DATA? CIRCLE FYI 96, p. 163)

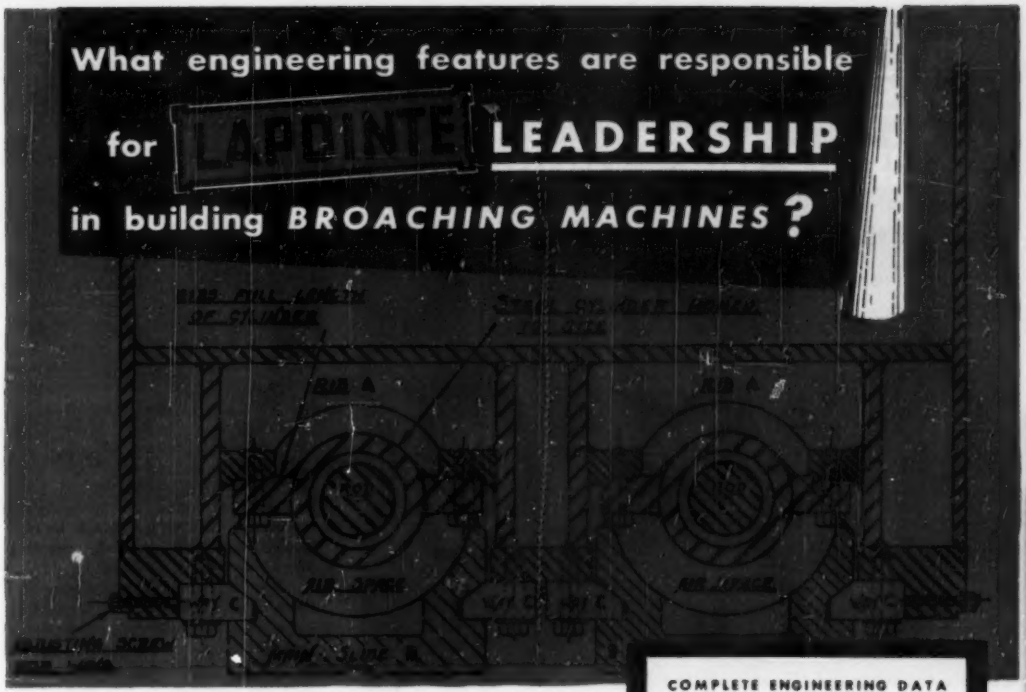
Precision machine-ground tungsten-carbide rotary files and ground-from-the-solid carbide end mills and reamers, made of tungsten carbide, are said by manufacturers to outlast ordinary carbon and high-speed steel rotary files more than fifty times without regrinding. End mills are available up to ½-in. shank dia. Reamers are ground with an odd number of flutes to oppose a crushing load on the cutting edges in order to ream to closer tolerances.

The Charles L. Jarvis Co., Middletown, Conn.
(MORE DATA? CIRCLE FYI 97, p. 163)

Heat-Rem high heat-resistant aluminum paint is for exterior and interior metal surfaces where a temperature range of 1000 to 1500 F is encountered. Silicone in the paint is reputed to enhance its luster to provide smoother coverage with greater weather resistance. It also increases water repellence. It sets in four hours and dries completely overnight. It is packaged in ½-pint, pint, quart, gal. and 5-gal. cans.

Speco, Inc., 7308 Associate Ave., Cleveland 9, Ohio.
(MORE DATA? CIRCLE FYI 98, p. 163)

What engineering features are responsible for LAPOINTE LEADERSHIP in building *BROACHING MACHINES*?



RIGIDITY is essential

. . . as every Master Mechanic knows! This drawing shows how Lapointe Vertical Broaching Machines are designed for *maximum rigidity and ruggedness*, absolutely necessary for proper performance.

A Note how the strong, heavy ribs are placed and braced, to insure against any vibration, shock or strain. Here is the very backbone of the machine.

B The main slide is *heavy*, designed to carry the broaching tools in a positive, firm, effortless cutting stroke.

C Ways are automatically lubricated, and adjustable in two directions by a simple jack-screw. Being twice as long as the slide, the slide never comes off the ways even when the full stroke of the machine is used.

LAPOINTE takes the responsibility for the entire job — machines, tools, and fixtures. That's a big reason for Lapointe Leadership . that's why "Lapointe's the way to *better broaching!*"

COMPLETE ENGINEERING DATA

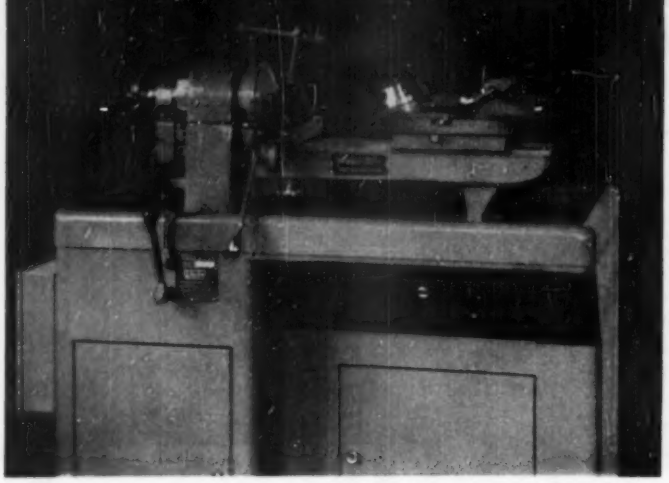
and dimensions on double ram and single ram LAPOINTE Vertical Broaching Machines will be found in these two illustrated bulletins. You are invited to send for Bulletins DRV-2 and SRV-2

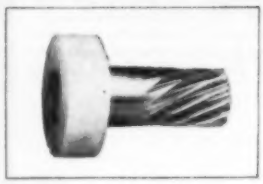
LAPOINTE Vertical Broaching Machines are all built to JIC Standards at no extra cost.

THE Lapointe MACHINE TOOL COMPANY

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

Wade offers you . . . 3 Times the Production





George Waterman, Superintendent of Massachusetts Gear & Tool Co., Woburn, Mass., increased turning production of a nylon gear to 3 times his former volume, because operators could load and unload work faster by stopping and starting the headstock spindle with the Wade type drive.

He maintains constant production within precision tolerances as no deviation occurs from the original set-up.

At 3300 r.p.m. spindle speed, the nylon blank is turned to O.D. just under 1", maintaining a tolerance of ± .0005".

The Wade Hand Screw Machine is so easy to operate that less expensive, inexperienced machine operators can produce with excellent results. Our Sales Engineer will be pleased to call and introduce you also to **INCREASED PRODUCTION.**

SAVE WITH INCREASED PRODUCTION AND LOW INITIAL MACHINE COST.

THE Wade TOOL CO., 53 River St., Waltham, Mass.

Reg. U.S. Pat. Off.

ROUND TABLE *Discussion*

DRESS UP OR DRESS DOWN

To INSURE the observance of accuracy, and also of that standard of dignity commensurate with a company's reputation, is it not desirable that all bulletin boards be placed under control of some responsible official as, say, the company's secretary? He legally represents the company; is responsible for the issue of all official bulletins and could easily arrange for the overseeing of any unofficial matter which may be submitted for posting. If the rule were made that nothing would be posted unless signed by this or some other designated officials, he question of exhibiting pin-up girls, in the nude or otherwise, would be controlled, as well as their removal when no longer current.

After all, foremen are chosen for their technical and production knowledge and supervisory capacity, rather than for their knowledge of esthetics or publicity. They should also not be distracted from their legitimate duties by matters of this kind.

P. E. James
Lincoln, England

•

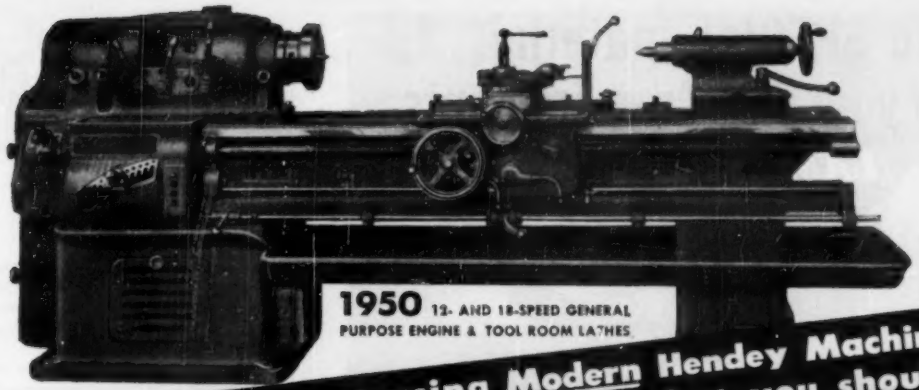
EMPLOYMENT PREVIEW

ORGANIZATIONS that are large enough to need a person to take charge of their employment duties can profitably employ one. Such a person should have a good understanding of human nature and be capable of bringing out the strong as well as the weak points of a prospect during an interview, thus being able to determine if the one making application is one of good habits and sound judgment, in fact whether he is a good citizen or not, and one that is likely to get along well with others.

The job also requires one capable of placing the majority of the employees where they will best fit as well as foresee and reject the undesirable applicants.

However, it is the foreman of a department who is usually more competent to judge those who are needed for the special and high-grade work.

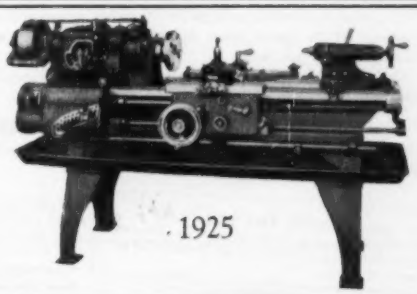
Although the hiring department should be, and in most cases probably has been, informed of the special requirements, it is well for the hiring department to turn such applicants over to the foreman for the



. . . If you are not using Modern Hendey Machines you are not earning the profits that you should!

Hendey Engine and Tool Room Lathes have been, and always will be, tops for accuracy. But, are you aware of the many other modern features of the new Hendey line? Like all Hendey Lathes, the 12- and 18-speed now have induction hardened and precision ground bed ways for both carriage and tailstock. Every important unit has fully automatic lubrication. The rear end of the spindle is graduated for indexing when cutting multiple threads, and there are 36 thread and feed changes. The precision, all-geared headstock is powered from a built-in motor in the cabinet leg. Spindle speed ranges from 19-1000 R.P.M. A choice of cam lock or long taper key drive spindle noses. Modern Hendey Tool Room Lathes are available with swings of 9", 12", 14", 16", 18", 20" and 24". Write today for full details and complete specifications.

This 8-speed Hendey Engine Lathe has long been obsoleted by the all-new Hendey 12- and 18-speed lathes. The 8-speed bed is not hardened and precision ground. Maximum spindle speed is only 426 R.P.M. Although a masterpiece of design and construction in its day, the 8-speed has been replaced by progressive manufacturers, because the 12- and 18-speed offer every modern improvement necessary to earn maximum profits.



Continuous, advanced engineering by Hendey is worth watching — and must be watched if you are to earn full profits from your lathes and shapers. For complete particulars and prices, contact your nearest Hendey office.

MODERN Hendey

THE HENDEY MACHINE COMPANY
MAIN OFFICE & PLANT: TORRINGTON, CONN.
BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco
REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh

LAMINUM looks like solid metal, but it's actually made up of .002 or .003 inch layers of first quality shim stock, metallically bonded together. Peels easily with a penknife.

LAMINUM, the metal that peels, comes in a wide range of thicknesses and laminations. Here is the basic information on this versatile, money-saving material.

STANDARD STOCK 8" x 48" SHEETS
BRASS AND STEEL

Gauge	.002 inch laminations	.003 inch laminations
.006	x	
.008	x	
.010	x	x
.016	x	x
.020	x	x
.032	x	x
.048	x	x
.062	x†	x†
.094††	x†	x†
.125††	x†	x†

†Also available as half laminated brass and half solid brass.
††Available in brass only.

PROPERTIES & SPECIFICATIONS

BRASS – Raw material is a commercial half hard high brass conforming to Federal Spec. QQ-B-611a, Comp C, half hard (5/27/44). The *laminated* brass conforms to Navy Aeronautical Spec. S-122, Aeronautical Material Spec. AMS-4508, Navy Ordnance Spec. 47B6.

STEEL – The raw steel used in LAMINUM conforms to Federal Spec. QQ-S-636, Condition 2, as well as SAE-1010. There are no government specifications on the finished steel LAMINUM.

Normally all LAMINUM stampings are made by us to our customers' specifications. However, for repair and maintenance work, some of our standard stock is available from your industrial distributor.

SHIM SIZE IS VIRTUALLY UNLIMITED

We've made some shims as large as 102 inches across—and others as small as your fingernail. With special joints developed over the years, we can make any size LAMINUM shim you want.

Other than standard thicknesses and lamination arrangements can be supplied upon special order.

BABBITTED SHIMS PREVENT OIL PRESSURE LOSS

Shims for use in split bearings can be fitted with babbitt lugs to prevent oil pressure loss without shaft scoring.

LET OUR ENGINEERS HELP YOU... We've been designing shims for 37 years. Why not throw that problem of yours at us? There's no obligation, of course.

SEND TODAY
FOR OUR ENGINEERING DATA FILE with all the quick facts on LAMINUM plus a free sample for your inspection.

*LAMINUM is used primarily for shims. But these facts may spark other thoughts that we'd be happy to help you develop.

LAMINATED SHIM COMPANY, INC.
3107 UNION STREET GLENBROOK, CONN.

CUSTOM SHIMS

STAMPINGS SHIM STOCK AN-COR-LOX NUTS

last word. This action would be only occasionally required and would not consume much of the foreman's time, but would result in better decisions and also preserve harmony in the organization as a whole.

Abel Blakeman
Watervliet, N. Y.

•

KICKBACKS

ANY incentive system, particularly where the toolroom is concerned, should be approached with a great deal of caution, or someone is going to get his fingers burned.

As I see it, the scheme outline in the discussion is primarily concerned with tool and die work, which is quite different from run of the mill production work, because here are involved higher limits of precision and quality. If this combination die is expected to produce, let us say, half a million pieces, and it fails to perform satisfactorily because the toolmaker "cut corners" in order to make an extra dollar, a dissatisfied and disgrunted customer is going to take his business somewhere else.

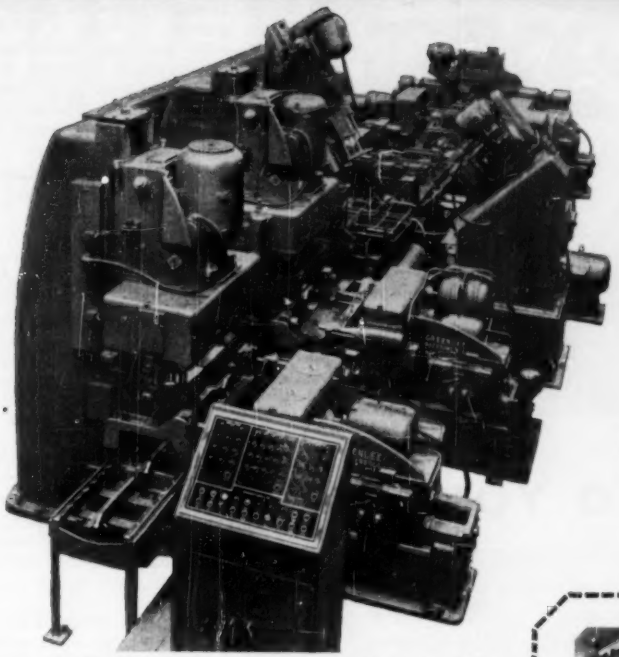
What will it profit the company to cut production costs, if a reputation for quality flies out the window and repeat orders fail to materialize?

In my opinion, this business of "showing the estimator up" is bound to produce certain reactions that cannot help but be unfavorable to all concerned. First, let us take the estimator. Suppose Ed's man Brown completes the work in hand well under the estimated time. What is going to happen when and if the same job comes up again. Are the estimates going to be revised?

I think the estimator is going to make it harder, somewhat harder, for Brown to earn the same amount of "kickback" on the repeat order. Let us assume, for instance, that Brown chopped 10% from the estimated time on the first order. It is quite within reason to expect that the estimator will take one-half of that time-saving when the job comes up again, leaving brother Brown the option of working harder to attain his original kickbacks, or keeping his original pace and earning half the previous bonus. Either way, he is going to lose some of his enthusiasm. When you multiply Brown's case by 20, 50, or 100, depending on the size of the shop force, you are bound to get definite repercussions that cannot fail to impair shop morale.

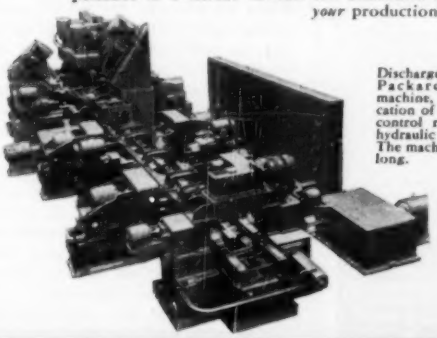
In the final analysis, I am inclined to thing that incentives of the "kickback" type do not belong in the tool-

GREENLEE

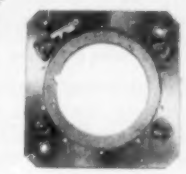


95 OPERATIONS EVERY 72 SECONDS ON *Packard* TRANSMISSION BELL HOUSINGS

AN INTERESTING feature of this machine is its ability to get at the piece from six directions — top, bottom, and all four sides. This is accomplished at two special stations, one which tilts the fixture up on edge for inside work, and one which turns the plate 90° before it goes through the remaining stations. This modern production unit is a 22-station Automatic Transfer Machine which performs a total of 95 drilling, reaming, spot-facing, chamfering, and tapping operations on the end bell of the transmission housing for Packard automobile engines. The cycle time is 72 seconds, giving a capacity for the machine of 40 completed pieces per hour at 80% efficiency. Greenlee machines have pioneered many of the outstanding advantages inherent in Transfer Process equipment — this experience is available toward the successful solution of *your* production problems.



Discharge end of the Packard end bell machine, showing location of the electrical control rack and the hydraulic pump units. The machine is 47 feet long.



FIXTURE

WORK

TWO VIEWS OF WORK ON FIXTURE

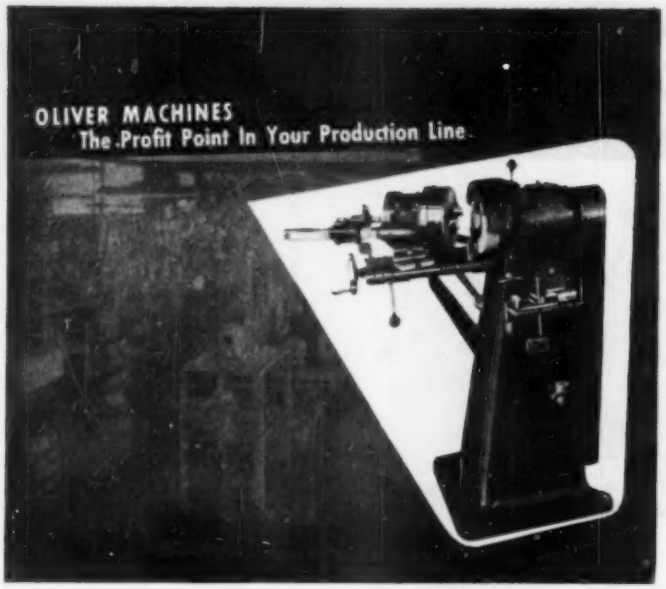
PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & COMPANY

1727 MASON AVE., ROCKFORD, ILLINOIS

MULTIPLE SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES



FREE TO YOU!

Oliver of Adrian invites you to send them a half dozen of your dull twist drills. Your drills will be sharpened on the Oliver Automatic Drillpointer, free of all costs to you. The Oliver of Adrian Drillpointer will give your drills the highest operating efficiency. 100% or more holes per grind, extend the productive life of the drill and give top accuracy on the toughest drilling job.

The Oliver requires only 60% of the feeding pressure and only 75% of the horsepower to operate as compared to other grinds.

Drills ground on the Oliver Automatic are perfect for multiple spindle drilling because of Oliver uniformity.

The Oliver Drillpointer can be operated by unskilled help. The Oliver will give you the right drill point for every job, increase your profits and reduce production costs.

MAKE US PROVE IT

Send your drills today. See the results in your own toolroom. . . . Remember, no obligation. If you are unable to send your drills, write for complete information on the Oliver of Adrian Automatic Drillpointer.

OLIVER INSTRUMENT CO.
1414 E. MAUMEE • ADRIAN, MICHIGAN

AUTOMATIC DRILL GRINDERS · TOOL & CUTTER GRINDERS · DRILL POINT THINNERS · TEMPLATE TOOL GRINDERS · FACE MILL GRINDERS · DIEMAKING MACHINES

room. When you are working to tenths, haste can very often lead to waste. I have seen very few toolmakers who liked to work under pressure—not that they cannot do it when the occasion arises—but training and habits enter into the situation. The toolmaker's craft places the emphasis more on quality than on quantity. I think if Ed forgot about his "kickback" proposition and studied each job carefully so that each operation went to the man and machine most suited to perform it efficiently, he would have fewer headaches and less spoilage.

Robert S. Alexander
Greenville, R. I.

•

A KICKBACK is fine for the diemaker, Ed, because it amounts to an hourly raise; but Brown could be smart enough to normalize his income and health by abstaining from work over the year, to his own advantage and the company would consequently gain very little beside a quicker delivery date on the die (when made under the estimated time).

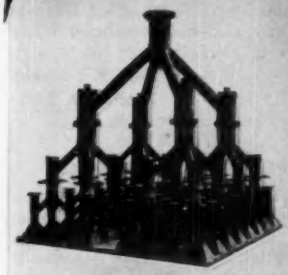
It certainly is quite an experiment, as the estimator is definitely "on the spot," with costs of paramount importance as far as his superiors are concerned and diemakers wanting a socalled square deal or as much time as possible for more money for extra effort.

Ed should also think of the inclinations of his men under an added incentive plan, namely that machines will be respected less and perhaps not lubricated as often or cleaned as thoroughly, due to a new main thought in the worker's mind.

Perhaps Brown will try to edge in on a machine ahead of Tom or while Dick is gone to the lavatory, Brown will set Dick's die on the side at an opportune moment and do a bit of work hurriedly and nervously while peeking occasionally at the entrance for Dick's return. This naturally could be grounds for an argument at least, and perhaps a start of breaking up departmental harmony. Or worse yet; it may mean that an excellent worker like Brown or Dick would resign when their die is only half-finished.

To save time, Brown is inclined to give less care and thought to quality of workmanship and in time get comparatively careless. If Brown was like a true artist with talent and skill but no business genius, then speeding up will test his mental and physical character and he will weaken quicker, just as a good baseball pitcher who works on the mound too often. I hope Ed has the sixth sense

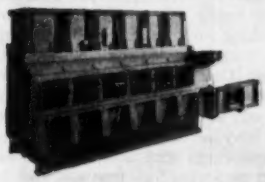
Steel-Weld FABRICATION



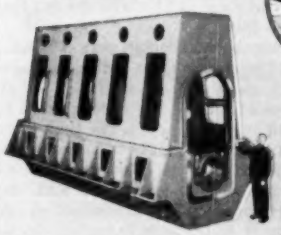
One of Several Parts of a Catalytic Cracking Plant Produced for the Petroleum Industry.

Pressure Vessels for the Chemical and Allied Industries.

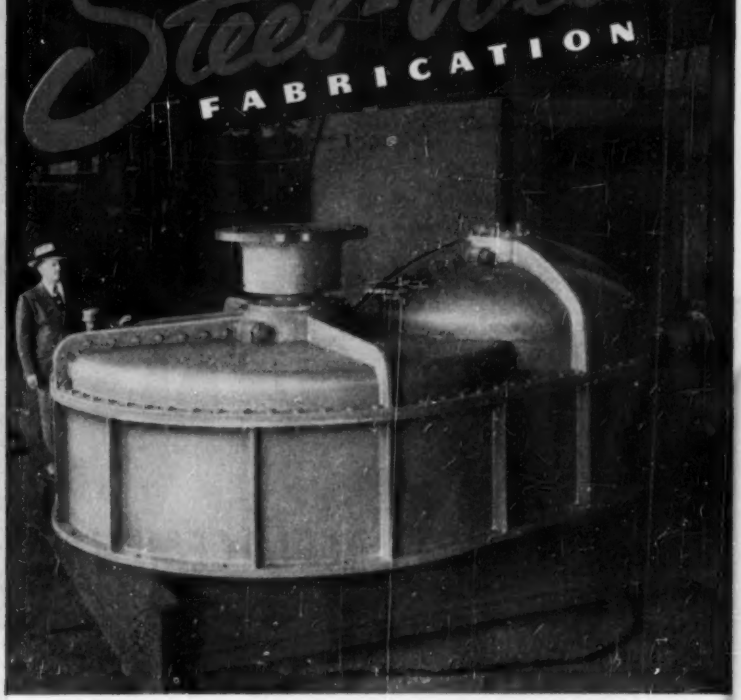
Heavy Press and Machine Frames and Bases for the Machine Tool Industry.



Diesel Engine Crank Cases and Frames for the Marine and Electro-Motive Field.



Crank Cases, Frames, and other Parts for Manufacturers of Marine Steam Engines of Uniflow or Multiple Expansion Type.



The heavy gear reducer illustrated above was fabricated, completely machined and assembled by the Steel-Weld Division of The R. C. Mahon Co.

The heavy gear reducer above, and other units illustrated on this page, are typical of thousands of Steel-Weld Fabricated parts and major assemblies produced by Mahon for manufacturers of heavy machinery and equipment throughout the country — evidence of skillful designing and advanced technique in fabricating procedures. You, too, may find savings through Steel-Weld Fabrication . . . and, you will find in the Mahon Company an unusual source for welded steel in any form for any purpose . . . a source with complete, modern fabricating and machining facilities, backed by a staff of competent design engineers and craftsmen from whom you may expect a smoother, finer appearing job, embodying every advantage of Steel-Weld Fabrication.

THE R. C. MAHON COMPANY
DETROIT 11, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

THE NORTHERN PACIFIC TRANSPORT COMPANY

. . . a very prominent western transportation company, operates a large number of motorized vehicles in the states of Montana and Washington. The operation of their equipment is extremely severe due to mountain grades and wide temperature variations.

They say . . . "THIS LUBRICANT CUT OUR PARTS REPLACEMENT 50%"

Quoting from their letter of October 17, 1949:

"We ran our first test on LUBRIPLATE #22 in March, 1945, in 3000 series Timken tandem-drive, worm axles. That year we experienced considerable trouble with wartime drivers and very poor roads, causing us no end of trouble. The oil that we were using set up to tar in 10 to 15 thousand miles. The LUBRIPLATE #22 proved so satisfactory we installed it in all our worm-gear, hypoid, and two speed axles. This enabled us to change our oil-change period from 15,000 miles to 40,000 and on some applications, depending on speeds and temperatures encountered, we raised the change period to 60,000 miles, or approximately once a year. Our overhaul periods were stretched from 50,000 to 100,000 miles, and repair parts bill cut 50% with the increased mileage."

Naturally with the economies that this company enjoyed through the use of LUBRIPLATE Lubricants on worm-axles, they extended the use of LUBRIPLATE to other parts of their equipment. The savings in parts, time, money and increased efficiency are equally startling. Let us send you the entire report of where they are now using LUBRIPLATE and what it is saving them.

LUBRIPLATE Lubricants will prove just as effective for you in your plant in reducing friction and wear. They are different from any other lubricants you have ever used. They save power, prevent rust and corrosion and definitely arrest progressive wear.

LUBRIPLATE Lubricants are available from the lightest fluids to the heaviest density greases. There is a LUBRIPLATE Product best for your every lubrication requirement. Let us send you CASE HISTORIES of savings that others in your industry are making through the use of LUBRIPLATE Lubricants. Write today.

LUBRIPLATE DIVISION
Fiske Brothers Refining Company
Newark 5, N. J. Toledo 5, Ohio

DEALERS EVERYWHERE . . . CONSULT YOUR CLASSIFIED TELEPHONE BOOK

LUBRIPLATE THE MODERN LUBRICANT

of judgment to coach Brown according to his health instead of waving a bonus prize in front of him ignorantly, as nobody continues in the "pink of condition" all his life.

John P. Podlecki
Kitchener, Ont.

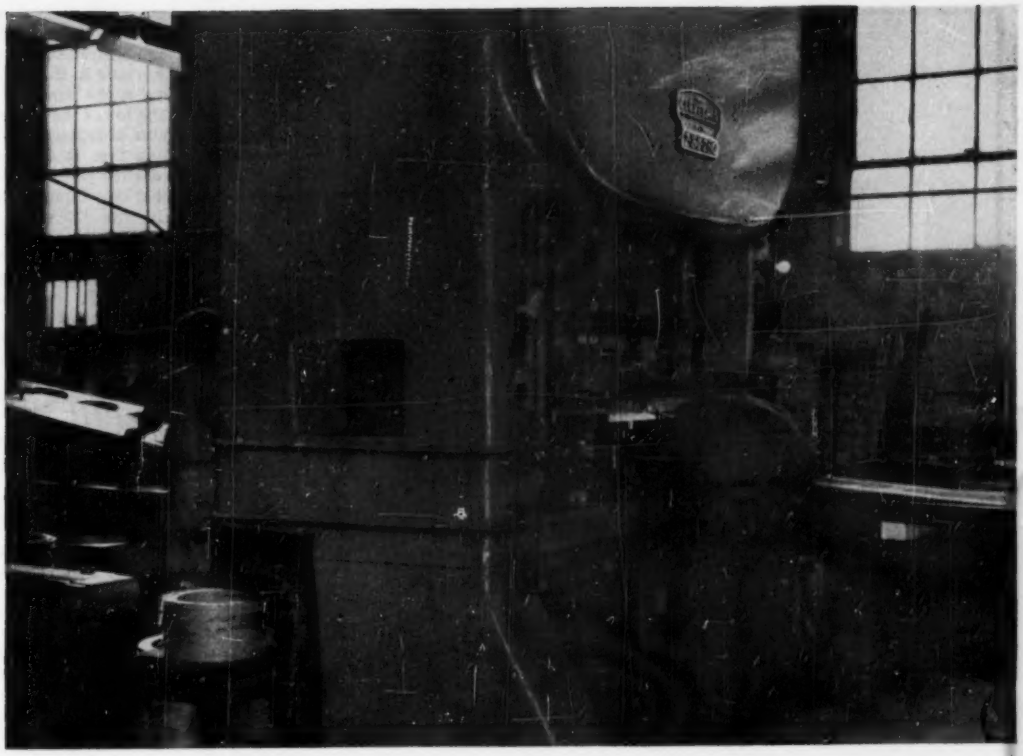
•

PLANNING COMMISSION

HURRAH for the planning commission thought! Now we have a foreman who is really looking ahead to a better tomorrow and not one who is content to ride along with the tides and let come what may. If these planning ventures are carefully planned and the right type of thought put into executing them, they are one of the best assets of any plant. Who doesn't want to have his say in front of the brass? Let them know that the head is used for something besides a rack for the new straw. There are lots of ideas that never bear fruit because there is no time and no one interested in listening to the advice of someone occupying a lower station in the whirl of things.

We plan today for the utmost in shop efficiency, experts poking their experienced noses into every nook and cranny for some better and faster way to expedite the job. Why leave this up to one or two of these so-called efficiency guys? I believe the boys in the shop can almost do as good a job at it if given the chance and boy, does it make them take pride in their work when some little thought has been put into practice. Ed is really off on the right foot. Spending some of his valuable time in a manner that denotes top efficiency. Catching the trouble before it becomes a problem. We expect the best out of the men we hire. Therefore why settle for less on the type of equipment that these fellows are hired to jockey? A few minutes by a skilled hand can save hours of repair work, just by noticing that the old piece of cast iron doesn't feel quite like she should.

This is something that a novice can't be expected to notice. It comes with many years association in all types of jobs. If the equipment is in need of repair, now is the time to do it, not after it really becomes necessary. If the tool is outdated, is no longer able to keep pace with the operators or the time sheets that call upon it to perform herculean tasks, remove it. There are lots of small shops, one- and two-man places that would gladly buy the relic and take it off your hands. They aren't interested in time-saving devices, only the will to make something of their



After 100,000 stampings no noticeable die wear!

At the Lakeside Metal Stamping Company of Cleveland, the Two-Point Cleveland Press shown above has been in steady operation for over seven years. In that time, according to Mr. Ollie Miller, plant manager, it has never been down for a major overhaul, control has always been fast and accurate, the gibs have required no attention in four years. "Best of all," Miller added, "It is the easiest Press on dies that I have ever seen. Often we have stamped over 100,000 airplane brake drum rings from a single set of dies, with no noticeable die wear. During these runs we held to a tolerance of .004"."

Because similar outstanding Press performances are being compiled daily by Clevelands, we are confident in urging you to investigate the production economies built into every Cleveland Press. Get a Cleveland—its trouble-free operation, rigid construction and exact control, provided by the patented Cleveland Drum Type Clutch, will give you lower production costs and longer die life.

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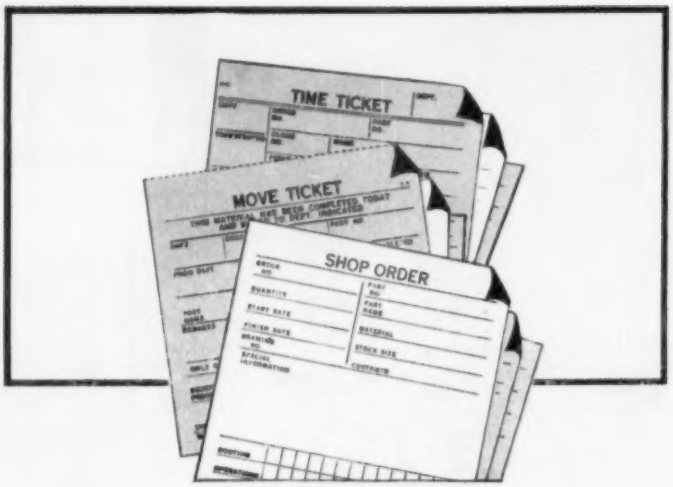

Take the "Paper-Work" out of Production Control and Costs!

How many different people copy and recopy essential data from your Shop Orders, Time or Transfer Tickets and other shop forms for control of your Production, Payroll and Costs? It frequently adds up to a lot of expensive "paper-work" that's subject to the delays and mistakes of many hands and heads.

Whatever Control you want—Machine Loading, Dispatching, Progress, Work-in-Progress or Costs, for example—you can have it promptly with less clerical work with McCaskey "one-writing and visible-filing." And your data will be visual, up-to-the-minute, prompt and dependable.

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own. In a modern production shop there is no room for a piece of equipment, even though sentiment runs high in favor of keeping it, that cannot hold up its end of the bargain.

If the brass at the top of the ladder cannot see the value of replacing the worn relic for one that is capable of producing the desired results, then a change should not only be made in equipment. Maybe the old man is getting worn out and in need of replacement. I say let's give the men the best that industry has to offer in the way of tools, and who knows best the equipment needed for a task. The foreman in the shop is my choice. If he isn't capable of making decisions of this importance, then you have the wrong man heading your gang.

Jack Bell
Bakersfield, Calif

•

CACHE OR CONFESS?

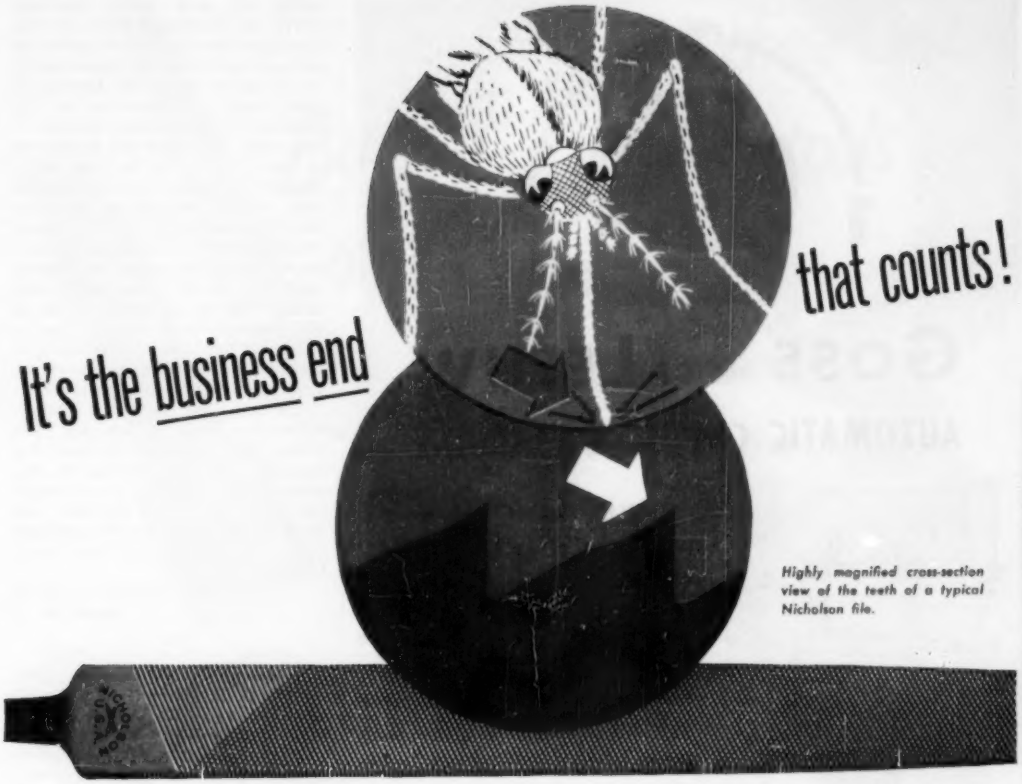
DURING the last world fracas, I was a foreman in charge of a minor machine and sub-assembly department which also included the "trainee" department upon which other divisions drew when openings appeared or additional manpower was needed. Average manpower in this department totaled 40 to 50 people, with an average turnover to other divisions of one or two persons each per week.

With the background that each trainee had (coming from stores, offices, trucks, etc.) spoilage would, on the surface, appear inevitable. However, management was surprised that, of all the departments throughout the whole plant, sub-assembly held the efficiency emblem consistently, month after month, for low, if any, spoilage.

Even when a critical period arrived, when material was short, this department had practically no metal to contribute to the drive. Why? Simply this: As each new man came into the department, he was instructed in his phase of the job, told of its eventual portion in the picture as a whole, and how important it was that it should fit in with dependence upon him for its so doing.

Man to man — one human to another—with neither of us infallible to mistake—and stressing the importance of keeping mistakes to a minimum, I put it up to each man that he was doing both of us a favor if at any time something went wrong that he call it to my attention right away, and not try to do something about it himself—such as plugging up holes, roughing up a surface, rounding off nicked edges, trying to extract a broken drill or tap, etc., or

It's the business end that counts!



Highly magnified cross-section view of the teeth of a typical Nicholson file.

FROM the standpoint of filing production, a file is only as good as the tips of its teeth. And thereby hangs a tale! . . . a story of research and experiment that takes in 86 years of file-making experience.

How can *you* tell when file teeth are in tip-top shape? You can't see file-tooth quality. The surest way is to look for the trademark. If it's a Nicholson or Black Diamond, you're on the right track. For these world-famous files are made with great care in selecting steel of the right grain and quality; and with special attention to the hardening of their "business ends"—the tips of teeth that do the cutting.

Measure the stretch of your file dollars by the number of efficient file strokes you get out of a file —and your choice will inevitably be Nicholson or Black Diamond brand. Industrial distributors who value your patronage know they can hold it under the Nicholson guarantee of *Twelve perfect files in every dozen.*

FREE—*"FILE FILOSOPHY"*—16th edition of this famous book on manufacture, kinds, use and care of files available to executive, purchasing and production heads, shop foremen, key mechanics. Send for it.

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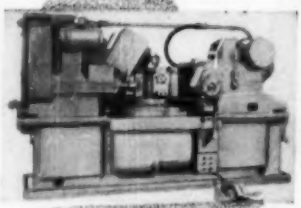

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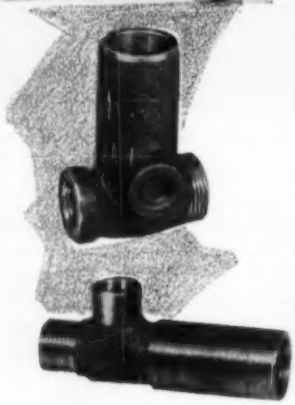
When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.



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hiding the part (which shortage would not be noticed until the end of a run of the contracted number of parts, or he had left the department), or taking it out to be thrown in some sewer—provided he ran the gauntlet of the company guards.

In turn, he gained my confidence as one to be trusted to show to me any defective part, (which was then kept for raw trainees, as we were allowed a certain percentage over excess) with no throwback and rejection from the inspection department with a consequent black mark; he also gained additional tricks of the trade in being shown how to overcome the fault in machining or assembly or future balky operations, a premium for honesty, as it were.

Nowhere was there an I-know-more-than-you-do attitude, but always there was the efficiency flag hanging over the doorway to our wing of the building to show that not only were we doing our best, but were actually the best—even though they had the title of "the lowly trainee."

Charles P. Desire
Bronx, N. Y.

•

It is obvious that the foreman should be appraised promptly by the workman of any work that is spoiled, otherwise he will not know of its occurrence or plan for its replacement with the promptness necessary to prevent unnecessary delays in the production schedule.

No one is perfect, therefore some spoilage is sure to occur and each case should be analyzed and disposed of with as little as possible delay and annoyance to all concerned.

The replacement should be made with the least possible delay and without reprimand if the operator's record is above average, as his mistake has caused him worry that should be dispelled without commotion.

In the case of an operator with an average record of spoilage, I would suggest an explanation be asked for by the foreman and advice given that will afford protection against the fault being repeated.

In cases where the operator is beyond the average in spoilage, the operator should be informed just what the loss means to the organization in both time and value of material together with the operator's standing with the organization. The latter of course would vary with the frequency of spoilage recurrence and might result in dismissal.

The foreman has a delicate and

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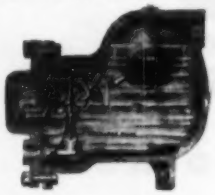

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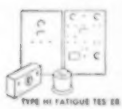

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difficult job in making his decisions. He will need to be guided to a considerable extent by the attitude of the operator, however his decision must be made without malice.

In some cases when piece work is involved it may be advisable to have the operator charged with the cost of spoiled material.

John Mark May
Watervliet, N. Y.

•

COST SHARK

CONCENTRATION on production is only half the picture in increasing profits of a company. The other half should be concentrating on cutting costs, regardless of the source of those costs.

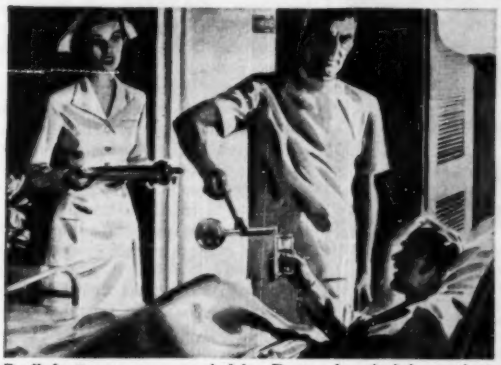
As the most obvious cost savings lie in being sure that every man in the department is working efficiently, the foreman stands in an ideal position to bring this condition to fruition. One way in which he can make sure that workers are performing efficiently is to place an estimated cost on every job that comes into his shop. The final actual cost of the job as compared with the estimated one is usually a good index of the efficiency of production in that department.

For higher productivity and lower costs, it is essential that a foreman be a "cost shark" and be able to estimate costs accurately on all jobs in his department.

When the foreman puts a figure on a job to let the men know what is expected of them, that is a far cry from putting that estimate in the same category as a "club" on the men on the job. Only a worker who is inefficient will drag out the excuse that the "cost shark" has "other fish to fry" in holding the men to his estimate. The good worker who knows that the foreman is honest, fair and cooperative will have no fear that the estimate is in the nature of a "club" over his head. This man can be depended on to do his best on a job and meet the deadline of the cost estimate. Otherwise he wouldn't be the efficient worker he is.

When foremen supply management with estimated and actual costs on jobs going through their departments, the company always knows where it stands with regard to costs, and can set a standard selling price to the customer. When costs are set up for the various jobs and are known to the foreman, this precise information can be used by him to evaluate methods, people, machines, and processes in his department. By keeping records of his estimated costs and actual costs on his various jobs, the

Atom pile by-products "fly" to help medical research



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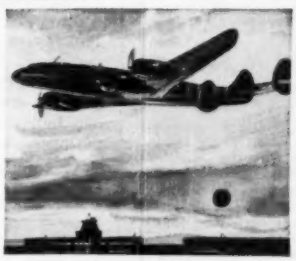

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foreman can, by comparison over a period of months, find out what the focal points for his departmental problems are. He can compare workers, machines, and alternate operating methods as to their efficiency and economy.

When the foreman prepares estimated costs, it helps to make him cost-conscious, and he will continually search for better, less expensive methods of doing the work. The foreman is responsible for costs; and if the costs in his department are too high, or high in comparison with those of other foremen, his rating as a company investment is not likely to be high. Therefore, the better the method for doing the job, the lower the cost will be from the viewpoint of management.

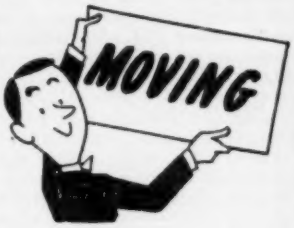
The blueprints for cost of operation in the foreman's department are the cost record and the data from them, properly analyzed and interpreted. They show up wasteful methods, poor uses of materials and supplies, and inefficient use of machines and materials. The cost-conscious foreman who prepares cost estimates on his jobs and who has the factors of his jobs well in mind will have a constant reminder of the specific sources of possible inefficiency in his departmental operations based on past performances.

Harry Kaufman
Philadelphia

•

THE JOB of estimating cost of work performed should be assigned to a qualified person who is familiar with physical conditions about the shop, has had considerable practical experience, and possesses that rare quality in a human being: common sense.

Call him a cost-shark, if you will—there shouldn't be any great difficulty in calling him anything, judging from the names I have heard his kind called in my active metal-busting days. I cannot see what is to be gained by having the foreman of a department spend considerable time concentrating on something which will detract from more important duties; his job is to supervise and in order to do that properly he needs every minute. Why transform a good foreman into a figurehead? While he is thoroughly acquainted with the ability of the men in his shop, and is aware of the condition of the equipment with which they have to work, such things as estimating the costs of jobs produced in his department should not be imposed on him. In order to do justice on a job such as estimating costs of vari-



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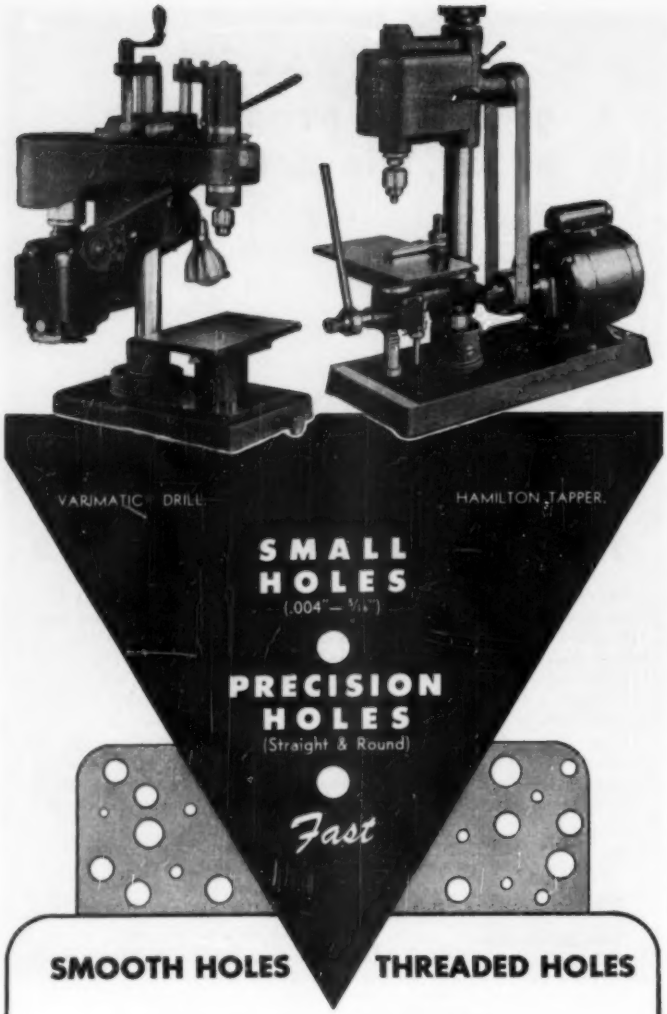
From The *American Machinist* Library of *Tips for Top Shop Men*

STUDY the trends and statistics, and be guided by them—but never forget that your customers, your suppliers and your workers are not statistics, but people.

NO two workers are alike, either in method of working or in temperament. Remember this when you teach methods or attempt discipline.



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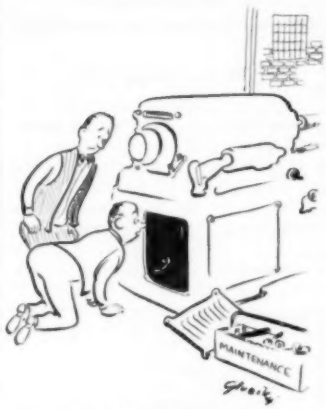
ous tools and machinery, one must have the quietness of an inner sanctum where he can concentrate to his heart's content, where the cost shark, lame-brain, or calculating Clarence may have freedom from distracting interruptions.

Imagine a foreman having such a luxury! I've seen shop bosses worrying over tool costs at their desks while some of the men under them took advantage of their preoccupation. An A‡1 estimator is a scarce jewel and is worth all the money paid to him. Some have a canny insight into the amount of time necessary to do a job—that mysterious innate ability to hit the cost of things on the head—while others, like myself, have to take the job apart and analyze it piece by piece and then proceed to estimate the time.

As for the workers taking objections to estimates being put on jobs: Any fair-minded individual should have no distaste in having a job given to him on which an estimate of time has been placed. Ordinarily the worker takes the job in stride and does his best—invariably doing the job within the calculated time. Contingencies may arise, obviously, as they do very often—which throw a monkey wrench into the schedule—but as a general rule the estimator allows 20 to 30% for such emergencies. If there happens to be an unjust expectation in what a man is supposed to do, his foreman will soon spot it and sue for an amended complaint.

Estimating is a necessary thing in modern production and should not be looked upon as a whip. True it is that it tends to inform the person what is expected, and thereby impells him to make the effort.

John Homewood
Ontario, Calif.



"I'm sure he's in there somewhere — I heard a voice."

Isn't this a pretty kettle of fish?

SURVEYS reveal an appalling misunderstanding among young people of the "facts of business life." For example, a poll was made among seniors in certain high schools which showed that they believe business profits are "over 50%" of the sales dollar, where actually profits average less than 8%. These students also think that stockholders receive 24% of the sales dollar, where actually it runs less than 3%.

Isn't this a pretty kettle of fish?

A greater part of the 8% of the sales dollar is reinvested in the business to expand and improve plant facilities which protects employment and creates new jobs for more workers.

Such ignorance is alarming. It is unfair to the young people themselves and dangerous to America's future. Such misconceptions open the door to socialism, communism and all the fantasies of the handout or "something-for-nothing" state of the economic dreamers.

Our school teachers say they *want* authentic information on the business system and how it works. Only business itself can supply the facts. You as a business leader in your community must share the responsibility for this misunderstanding. It is our civic duty to help overcome this misconception of everyday economics in the minds of our youth today.

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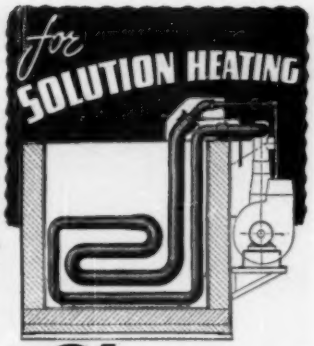

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Available in both suction and atmospheric types. Can be equipped with pilot, spark plug ignition and safeguard equipment.

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Write for Bulletin SC-142

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SURFACE COMBUSTION CORPORATION
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Jig Boring These Parts Cuts Production Time 90%

It took 3½ hours to machine each of these aluminum-alloy supporting arms, used on our Moore Panto-Crush Wheel Dresser, on a boring mill. Now—on our No. 2 Jig Borer—it takes only 22 minutes per piece for lots of 100—a time saving of 90%. Hole diameters and between-centers dimensions are held to 0.0002" to insure extreme accuracy between pivot points in the wheel dresser and allow the installation of precision bearings in the holes. Read the job details at the right.

Moore Jig Borers are being used more and more on short-run production of precision work—boring, drilling, reaming and inspecting precisely located and machined holes in production parts, as well as in dies, jigs and other tools.

Write today for our new 24-page catalog, containing other examples of time- and cost-cutting Jig Borer operations.

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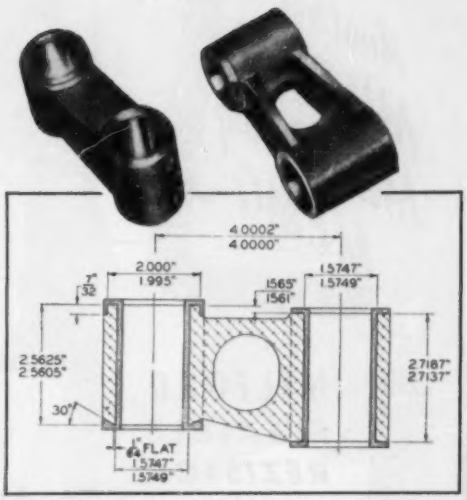
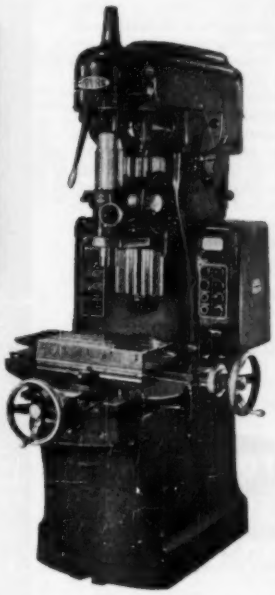


Two holes, three flat and one beveled face and shoulder on one boss (the areas crosshatched in drawing) are all machined on the Jig Borer—in only 22 minutes.

Everything done on Jig Borer, using easily-made holding fixture that provides both milling and boring positions

Oper. No.	Operation Name	R.P.M.	Feed	Min.	Sec.
1	Load and mill ribs — Single Point fly cutter	1000	H	1	00
2	Set Up and rough bore — two holes	2000	.0015	2	10
3	Rough face two top surfaces Single Point fly cutter — Remove part to cool —	1000	H	1	35
4	Load and second rough bore two holes	2000	.003	1	50
5	Finish bore two holes	2000	.0015	2	40
6	Check two holes for size			1	00
7	Rough and finish 30° bevel	800	H	3	00
8	Rough and finish one bottom face	800	H	1	00
9	Finish face two top surfaces Out-feed chuck	800	.0025	4	35
10	Rough and finish 2" diameter shoulder	400	H	3	00
	TOTAL TIME			**21**	**50**

Checking hole size—held to 0.0002". Simple holding fixture provides both boring and milling positions.



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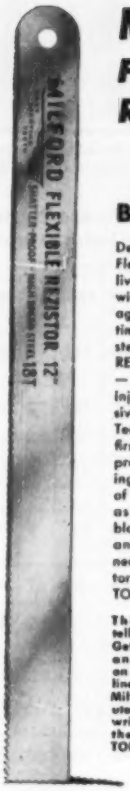

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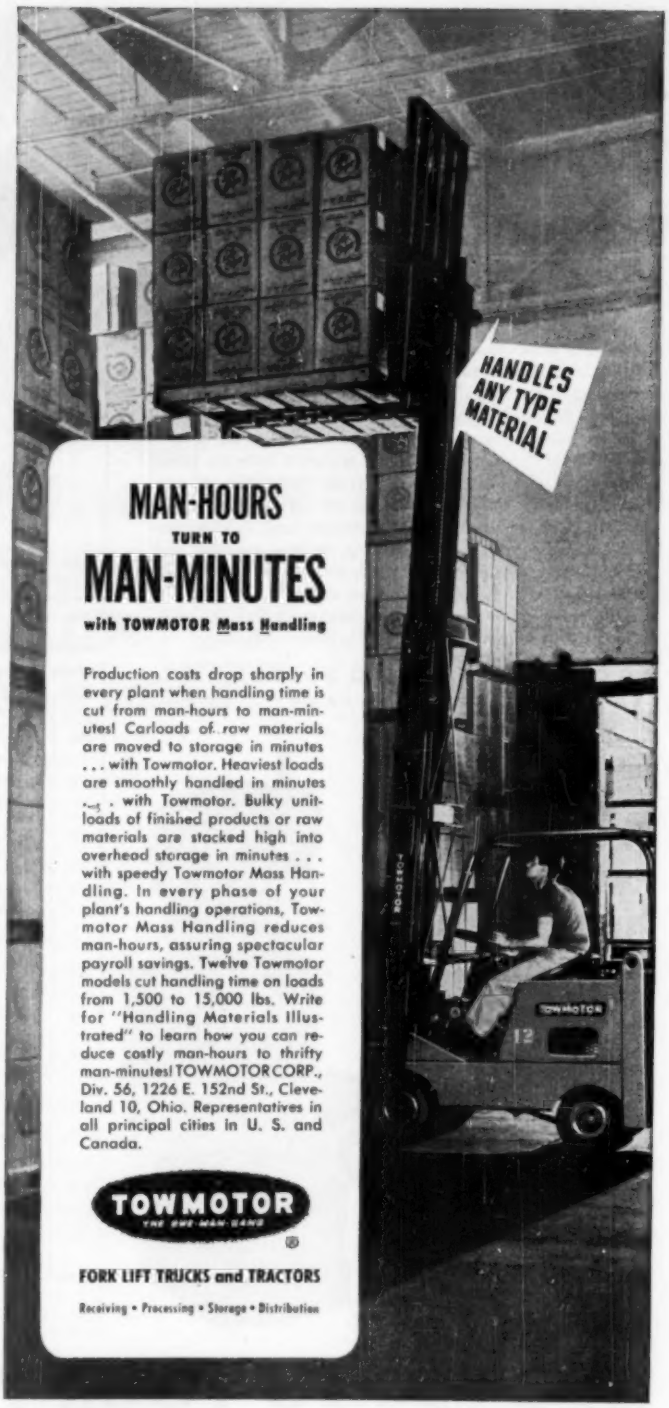

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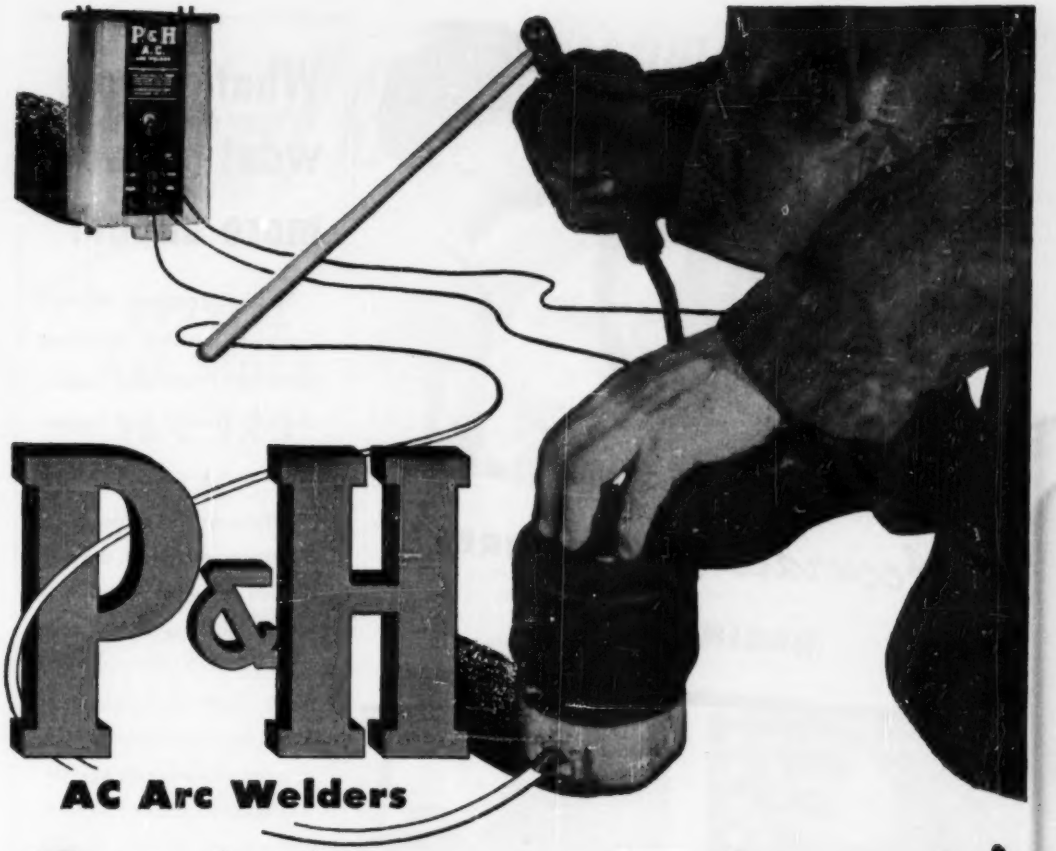

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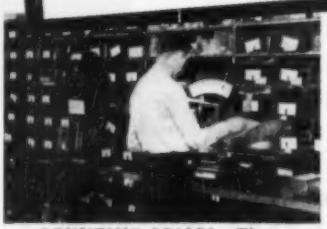

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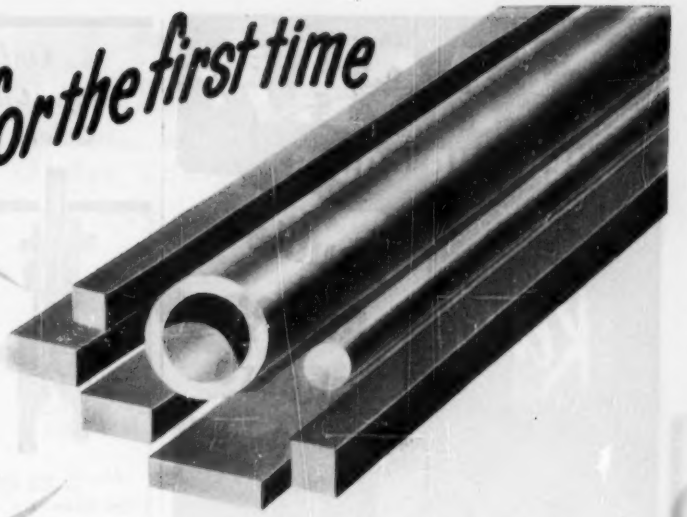

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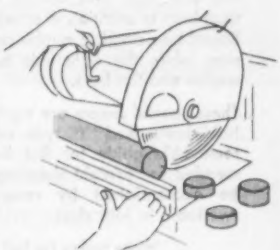

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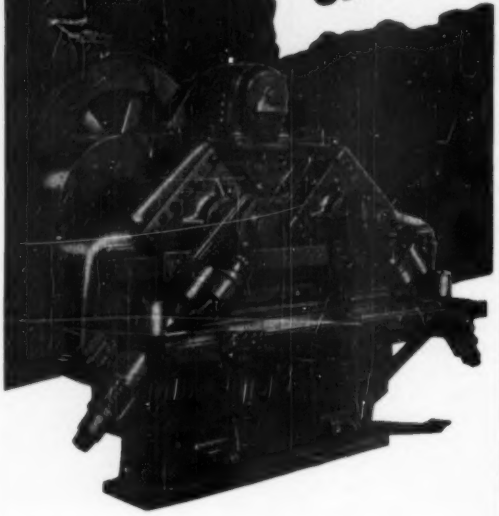

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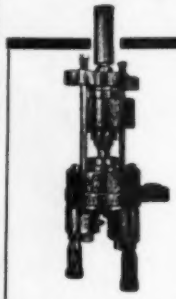

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No. Spindles: 2 to 6

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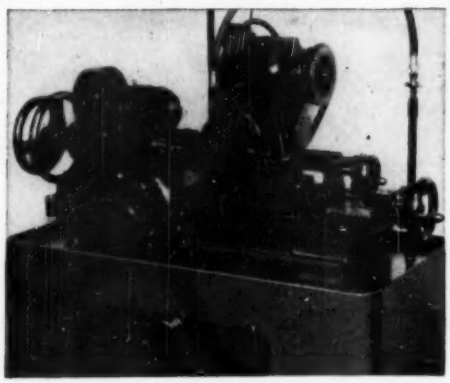

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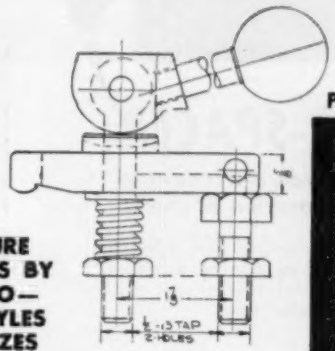

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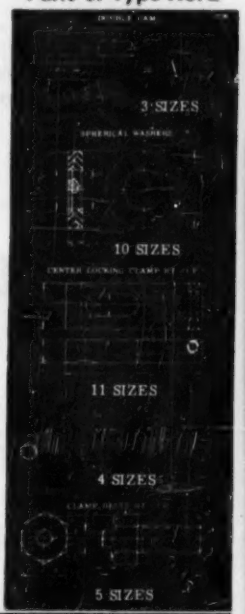

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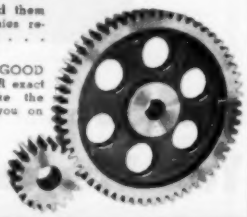

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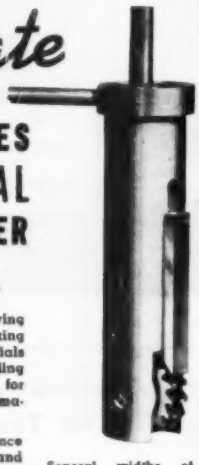
THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*



• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills — and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

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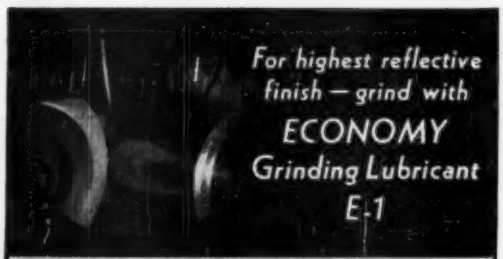

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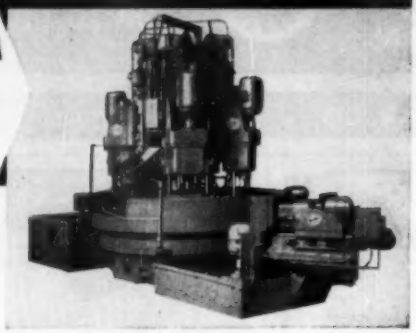

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Machines similar to this can be designed to handle dissimilar operations in the same parts or one operation on continuous production. An indexing table with ROTO-MATIC POWER HEADS is easily arranged to suit special machining operations.

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American Cancer Society

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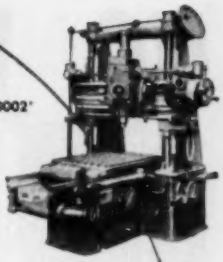
Working range . . . . . 40" × 28"
Table top to spindle end . . . 28 ½"
Free space between uprights 39 ½"
Boring capacity . . . . . 9"
Guaranteed accuracy: .0002"



No. 2H
Working range . . . . 16" × 10"
Table top to spindle end. . . . 19"
From spindle axis to column 13 ⅜"
Boring capacity . . . . . 1⅝"
Guaranteed accuracy: .0001"

SIP

Hydroptic-7
Working range . . . . 55" × 40"
Table top to spindle end . 37 ⅞"
Free space between uprights 63"
Boring capacity. . . . . 10"
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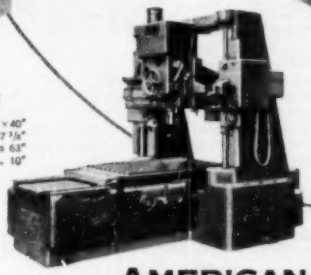
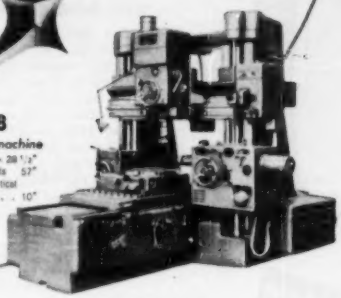


Hydroptic-8
Three-coordinate machine
Working range 55" × 40" × 28 ½"
Free space between uprights 52"
Boring capacity of both vertical and horizontal spindles . . 10"
Guaranteed accuracy: .0002"



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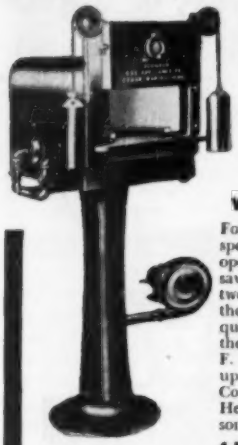

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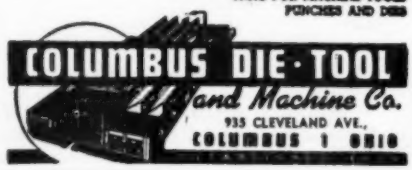

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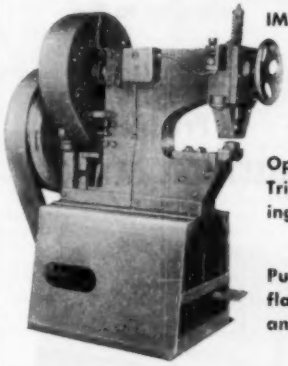

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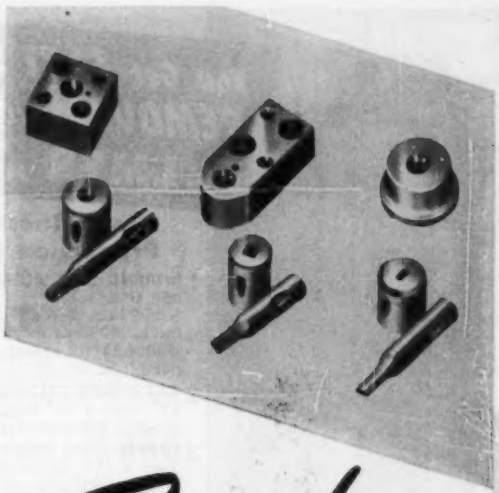

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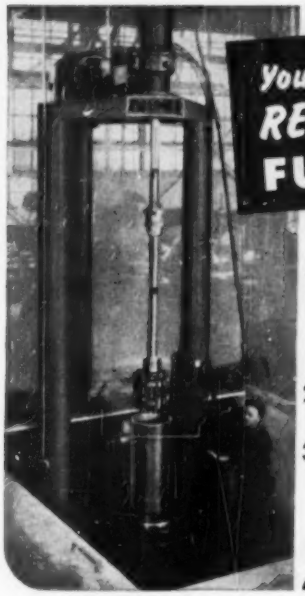

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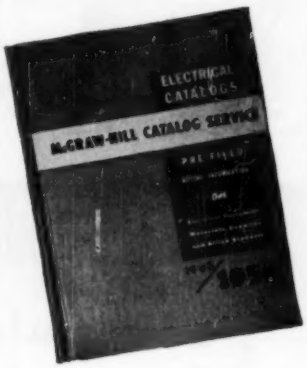

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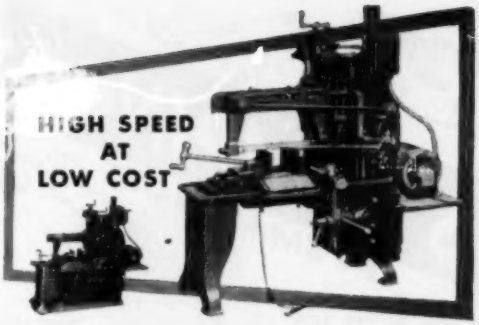

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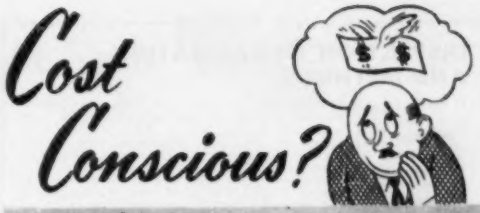

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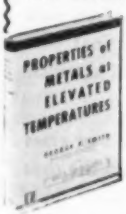

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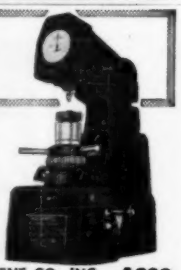

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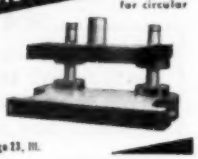

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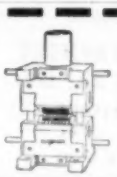

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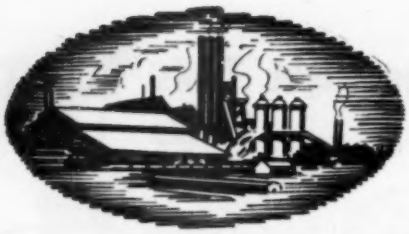
BE careful neither to underestimate nor to overestimate the men you pick for promotion. A man may make an excellent *production* executive dealing with details and concrete things, but be out of his depth when he faces the intangibles of *administration*. He may be a whiz at watching the trees and no good at watching the forest.

AN essential to efficiency is regularity. The brilliant, but erratic—or the fast, but frequently absent—man will rarely show any efficiency. Remember the hare and the tortoise.



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

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HOW TO GIVE METAL PRODUCTS THE RIGHT FINISH . . .

Here are economical, sales-building methods that produce more attractive products

SUPPLIES UP-TO-DATE INFORMATION ON:

- —the techniques involved in metal finishing
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- —the sales value of attractive finishes
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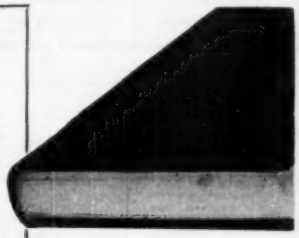
- —the design of parts which require finishing
- —new finishing equipment and processes
- —metal finishing costs



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FINISHING METAL PRODUCTS

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Consulting Engineer

and ADOLPH BREGMAN
Consulting Engineer, Executive Secretary, Masters Electro-Plating Association

Second Edition

352 pages, 5¼ x 8¼; 147 figures, $4.00

The revised edition of this highly useful manual describes many new developments, and incorporates the rapid progress in plastics and synthetic resins. Chapters on coloring metal, on costs and estimates and on organic coatings have been added. Answers to every kind of question which arises in connection with the finishing processes are supplied in careful detail, aiming at the most efficient and economical means of achieving a highly attractive finished product with a maximum of selling appeal.

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HEALD 48A, 49 single end, Borematic, Latest
LANDIS—#35—3½" bar, floor type, M.D.
LUCAS #43, 5" bar, Table Type, Latest Type
LUCAS #43, 5" bar, Table Type, Late Type
NILES-BEMENT-POND 5", 8" bar, Floor Type, M.D.
SELLERS 5" Bar Floor Type, latest type
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UNIVERSAL 5" bar, high speed, latest type

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BULLARD 24", 36", 42" Vert. Turret "Spiral Drive" High Speed, Latest Type
BULLARD 36" "Cutmaster", Latest Type
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NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

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LELAND & GIFFORD #2 LMS 6 spindle, Latest
NATCO #4AL Multiple, 30 spindles, Hyd, Latest Type

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BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
CROSS #1 Tooth Rounding Machine, Motor Drive
CROSS #50 Gear Chamferer, Latest Type
FELLOWS Model 6I, 6IA, #52, 7A, 72, 73S, 77 High Speed Gear, Shaper, Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #13LS Lapper, latest type
GLEASON #14 Hypoid Spiral Grinder, Latest Type
GLEASON 5", 12" straight bevel generator, latest type
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GLEASON #16 Hypoid Generator, Latest Type
GLEASON 24", 27", 77", 90" Straight and Bevel Gear Planer, Motor drive
GOULD & EBERHARDT 12H Hobber, DIFF., Latest
GOULD & EBERHARDT 18H Hobber, Motor Drive
GOULD & EBERHARDT 36H Hobber, with diff. M.D.
NEWARK #5, 72" Hobber with Infeed and Differential, Motor Drive
PRATT & WHITNEY 16" Grinder, hyd., latest
SCHUCHARDT & SCHUTTE #1 Hobber, Motor Drive

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BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
CINCINNATI 12"x48" Univ., Model ER, Latest Type
CINCINNATI 16"x36" Model E.R., Univ., Latest Type
LANDIS 4x12 Type H, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd. Latest Type
LANDIS 29"x120" Plain Roll, Motor Drive
NORTON 6"x18", 6"x36", 16"x36", 10"x72" Type C, Plain, Latest Type

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CINCINNATI "Monnset" Tool & Cutter, Latest
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GARDNER 24-53" Disc Grinder, Latest
GLEASON #12 tool sharpener, Latest Type
HEALD 72A3, 72A5 "Gagematic" Internal, Latest
HEALD 72A3, 72A5, Internal, latest type
HEALD #81 Internal Sizematic, Latest Type
HEALD #81 Internal, Centerless, Sizematic and Gagematic, Latest Type
KEARNEY & TRECKER Face Mill Grinder, Latest
LANDIS #6, 6x24 Thread, latest type
La POINTE 60" Universal Broach Sharpener, Latest
THOMPSON 6"x48" Auto. round broach M.D.

KEARNEY & TRECKER (MILWAUKEE) #2H Plain Horizontal Milling Machine—Timken Bearing, Size of table—50"x10", Latest type

VAN NORMAN #639, #73 Osc. Radius Grinder, Latest
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GRINDERS—Surface

ABRASIVE 3B, 8"x24" Hyd., Latest Type
BLANCHARD #11, 16" dia. mag. chuck, Latest
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HANCHETT Series 300 13"x18" Vert. Hyd., Latest
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HEALD 25A—rotary—16", 24", 30" chuck, Hyd., Latest

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LODGE & SHIPLEY 16"x30", 14"x30" Timken, Latest
LODGE & SHIPLEY 18x72 centers, M.D.
LoSWING 4x60, 4x84, 8x60, 8x108, 8x84, Latest
MONARCH 10"x20" Centers, Model EE, Timken, Latest
MONARCH 12"x30" Centers Model CKK, Timken, late
MONARCH 12"x54" Centers, Model CK, Timken, latest
MONARCH 24"x144" Ball Bearing, Geared Head, M.D.
MONARCH 22"x192" Centers, Model CM, Timken
MONARCH 22"x456" Centers 3 Carriages, Timken Bearing, Model CM, Motor Drive
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PRATT & WHITNEY 16"x20" Centers, Timken, Latest
PRATT & WHITNEY 10"x20" centers, Bench, latest
REED PRENTICE 20"x54" Centers, Model A, Latest
SPRINGFIELD 10"x30" Centers, Timken, latest type
WARD, HAGGAS & SMITH—18/30x66" centers gap, motor drive, Latest Type

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CLEVELAND 12"x16" Centers, Cutter, Motor Drive
MICHIGAN 1712 Universal, Latest Type
U.S. Tool #4108, 8"x15" Centers, Cutter, Latest

LATHES—Turret

BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fosterematic," Timken, Latest
GISHOLT 2IL, 2IL, #3L, Universal, Timken, Latest
GISHOLT #3, #4 Univ., Timken, Latest Type
JONES & LAMSON #3 Univ., Timken, Latest
LIBBY "International" 1IU Univ. Timken, Latest
MOREY No. 2B, No. 3, No. 4 Timken Bearing, latest
POTTER & JOHNSTON #5DE, Timken, Latest
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #3, Timken, Latest Type
WARNER & SWASEY #1A Universal, Timken Bearing, Pre-Selector, Bar and Chucking, latest type
WARNER & SWASEY 2A Universal, Timken Bearing "Pre-selector" Bar and Chucking, Latest Type
WARNER & SWASEY 3A Universal, M.D.

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GRAY 84"x52"x16" Planer Miller, 2 heads, Latest Type
HALL Style L, Planer Type, latest type
INGERSOLL 42"x36"x12" adj. rail, 4 heads, AC, M.D.
INGERSOLL 32x24x16" Planer Type 2 heads, AC, M.D.
INGERSOLL 30x24x12" adj. rail slab, M.D.
SUNDSTRAND Model 42" 3A Duplex 42" feed, Latest
TAYLOR & FENN M80 Duplex Spline, latest

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BROWN & SHARPE #12, 24" feed, Latest Type
BROWN & SHARPE #2-0, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
CINCINNATI 0-8, 1-12, 2-18 Automatic, Latest Type
CINCINNATI #3, #4, #5 High Power, Late Type
CINCINNATI 4-36 Hydromatic, Simplex, Latest Type
KEARNEY & TRECKER #2H, 3H, 4H, 5H, Latest
KEARNEY & TRECKER 1218, 1404, Simplex, Latest
KEMPSMITH #36, #4 Timken, Latest Type
KEARNEY & TRECKER 4K, Timken, Late

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LEES BRADNER Model HT, 12"x54" Centers, Latest
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PRATT & WHITNEY 4½"x12" Model C, Latest Type
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KEARNEY & TRECKER 2H, Timken, Latest Type
KEMPSMITH #4 Meel-miller, Timken, latest type
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VAN NORMAN #36, #36, Timken, Latest Type

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MOREY 12M Single & Double Spindle Profiler, Latest
REED PRENTICE 3VG, with or without hydraulic duplicator, Timken bearing, Latest Type

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CINCINNATI 96"x36"x8", 4 heads, PRT, DC, M.D.
CLEVELAND 48"x46"x12" Openside, Motor Drive
DETRICK & HARVEY 48"x48"x16" 4 heads, Hydraulic Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x42" 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
NILES 48"x18"x12" "Time Saver", Box Table, 3 heads, D.C. reversing motor, Latest Type
NILES 42"x42"x14" "Time Saver" Box Table, 2 Heads, PRT, VARI VOLTAGE Drive, Latest
NILES 96"x96"x24' 4 heads, Rapid Traverse, Box Table, D.C. reversing motor drive

PRESSES

BIRDSBORO 325 ton, vert, hyd., Latest Type
BLISS 75-35 Hydro-Dynamic, Double Action, Latest
CLEARING K-1200-50 Knuckle Joint, 200 ton, 4" stroke, Latest Type
GLEASON 15" Quenching, Hyd., Motor Drive
LAKE ERIE 500 ton Vert. Hyd., Latest Type
TOLEDO #30A, 88 ton geared, Motor Drive
NIAGARA 2-98B, 88 ton geared, Motor Drive

SCREW MACHINES—Automatic

CLEVELAND 9/16", 1-1/16" Model A, Latest Type
CONOMATIC 2¾"—6 spindle, high speed, Latest Type
CONOMATIC 3¾" 6 spindle High Speed, latest type
GOSS & DeLEEUW 7½" 6 spindle Chucker, Latest
GOSS & DeLEEUW 8" 5 spindle Chucker, Work Rotating, Latest Type

WATCH THIS PAGE

For MODERN high quality machine tools nearly all built new since 1941. These tools are priced well within your equipment budget. *Wire, write or phone for pictures, details and prices, today.*

SHAPERS & SLOTTERS

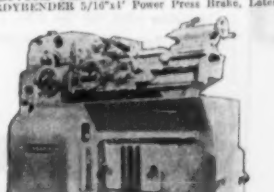
AMERICAN 20" Heavy Duty, Motor Drive
CINCINNATI 20" High Speed, Latest Type
DIEL 20"-24" Vertical, Motor Drive
LAMAIRE 18" Vertical, Hydraulic, Latest Type

SHEARS—Power

QUICKWORK #5, ¾" Cap., Rotary Sheet, M.D.
QUICKWORK #6, 1" Cap., Rotary Sheet, M.D.
WYSONG & MILES #572, 14 gauge x 6' Latest Type

MISCELLANEOUS

AJAX 3½" Forging and Upsetting, M.D.
BAKER #5 Keyseater Motor Drive
BARNES #172, 206H, 307, 307B Vertical Hone, Hyd., Self Oiling, Latest Type
CAMPBELL, #401 Abrasive Saw, Latest Type
DE LAVAL #194 Coolant Clarifier, Latest
FOSTER 4"x18", 4"x36" Superfinisher, Latest
HELLER Model SS-1 Cold Saw, 6" cap., M.D.
LANDIS 2 Single Spdle. Bolt Threader, M.D.
NATIONAL 4" Forging and Upsetting, Latest type
NAZEL #4B Pneumatic Hammer, M.D.
PEERLESS 14"x14" Hydraulic Hack Saw
PRATT & WHITNEY (KELLER) Type BL-2416 Type G Copying 2 and 3 dimensional, Latest Type
ROWBOTTOM Cam Miller, Motor Drive
STURDYBENDER 5/16"x1' Power Press Brake, Latest



MONARCH 10"x20" Centers, Model EE Toolmaker's Lathe, Timken Bearing—High Speed, Latest type

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AUTOMATIC SCREW MACHINE, #00 Brown & Sharpe, Cap. 5/16", Slotting Attachment, Coolant System, etc. THREE.

AUTOMATIC SCREW MACHINE, #0G Brown & Sharpe, Cap. ⅝", Slotting Attachment, Coolant System, etc. TWO.

AUTOMATIC SCREW MACHINE, #2 Brown & Sharpe, Cap. 1", Collet, Collet Chuck, Toolposts, Coolant System, etc. FOUR.

AUTOMATIC SCREW MACHINE, #2G Brown & Sharpe, Cap. 1", 2 h.p. 220/440 volts, Collet, Collet Chuck, Coolant System, etc. THREE.

APRON BRAKE, Cerweso 8' x 14 gauge. All-Steel. Hand Type.

BORING MILL, Botts 100" Vertical.

BORING MILL, Bullard 54" Vert. Spiral Drive.

BUFFER & POLISHER, U. S. Electrical Multi-Speed Double End #95, 3 h.p., 220 volts, Four Speeds up to 2700 r.p.m. Floor model.

BUFFER & POLISHER, Gardner #3DB Double Spindle with independent 7½ h.p. 220/440 volts motors & controls. Timken Bearings.

DRILL, Baker #314 Hvy. Pattern High Speed Vertical Boring & Drilling Machine, 7½ h.p. 220/440 motor, #3 taper, 12 feeds, 6 speeds, 12¼" throat, 3" Capacity in steel.

DRILL, Colburn #2 Manufacturing Heavy Duty All Geared Motor Driven, 3 h.p. single phase motor, reversing controls, #4 taper, 19" throat, 1¼" capacity in steel.

DRILL, Leland Gifford #2LMS Upright Sliding Head Two Spindle, #2 taper, 13" overhang, Independent 220 volts, 4-speed motors, indicated spindle speeds.

DRILL, Natco #12 Multiple Spindle Motor Driven, #1 taper, 3 h.p. 220/440 motor, Arranged for 18 spindles, Rectangular head, With Natco 24" Rotary Table.

STRAIGHT BEVEL GEAR GENERATOR 5" Gleason, Serial #18884, NEW—1942, 220/440 volts motors, Gear Cabinet, Full Set of Index Gears, Segments, Auto-Index Attachment, Pneumatic Chuck Equipment, Cutter Setting Gauges & Segment Setting Gauges, Duplete Cutting Cam & Duplete Feed Cam.

PARTIAL LISTING OF LARGEST STOCK IN THIS AREA

BASE PITCH & SPACE MEASURING MACHINE, #337 Illinois, Late Type—Like New. Capacity—12" diameter gear, 13" between centers. Full Set of Off-Set and Straight Contact Fingers, Dial Indicator, Tailstocks and Leatherette Cover.

GRINDER, Cincinnati #EA, 18" x 36" Hydraulic Cylindrical, Filmatic Bearings, 220 volts motors. Built-in electrics, Hydraulic Infeed.

GRINDER, Cincinnati #2 Universal Cutter & Tool, Model #EM, New in 1943, 220/440 volts motors, Cylindrical Grinding Attachment & lot of Equipment.

GRINDER, Bath 10"x25" Motor Driven Universal Surface, 220/440 volts motor with centralized push button controls, Internal Grinder Attachment & Steady Rest, etc.

KEYSEATER, Mitts & Merrill #5 Giant Motor Driven, 220/440 volts motor, Capacity—24" long, 3" wide Keyway, Automatic Feed.

LATHE, LeBlond 36" x 30', 220/440 motor, 12 speed head, taper attachment, steady rests, etc.

LATHE, Bridgeford 32" x 10' Q.C.G. Grd. Hd., 110' Centers, 2⅛" hole thru spdle, 15 h.p. 220/440 volts, internal geared faceplate.

LATHE, Hardinge #59 High Speed Second Operation Machine, 1" Collet Cap. Automatic Collet Mechanism, collets, collet chucks, etc. FOUR.

TURRET LATHE, Bardons & Oliver #7 Universal Grd. Hd. Ram Type. Hydraulic Speed Selector, 2½" Cap. 10 h.p. 220/440 motor, With Chuck, toolholders, etc.

TURRET LATHE — Warner Swasey #1-A Model #M-470 Universal 12 Speed Grd. Hd. Hvy. Duty Bar Feed Saddle Type, Cap.—3½", Power Screw Bar Feed & large lot of tooling, 220/440 volts.

MILLING MACHINE, Cincinnati #3 Vert. H.S. Dial Type.

MILLING MACHINE, U. S. #MMI-6 Cam Controlled Automatic Horizontal, #40 taper, Late Type, 220/440 motors. TWO.

MILLING MACHINE, Cincinnati #3 Dial Type High Speed Motor Driven Horizontal, 220/440 motor, Range: 34" x 12" x 20".

MILLING MACHINE, Van Norman #3V Ram Type Vertical, Late Type, 220/440 motors, Also stub arbors, arbor, vise, collets & cutters.

PLANER, Gray 38x38x14'. Four hds.

POWER PRESS, Bliss #34 S.S.S.A. 56 tons, 10" Stroke, 20" between uprights.

POWER PRESS, Bliss #73½ S.S.S.A. 122 tons, 5½" Stroke, 24" between uprights.

POWER PRESS, Bliss #3A S.S. Dble. Crank S.A. Grd. 45 tons, 4" stroke, 36" between uprights.

POWER PRESS, Toledo #91C S.S. Dble. Crank, S.A. Grd. 56 tons, 4" Stroke, 36" between uprights.

WHEEL PRESS, Niles B & Pond 200 Tons Hydraulic Horizontal, 48" between strain bars, Two Plunger Type, 7.5 h.p. 220/440 motor.

POWER PRESS, Bliss-Consolidated #77 Open Back Gap Frame Sgle. Crank Sgle. Action Back geared. 175 tons, 10" stroke. Bed area—24" x 42", With Roll Feed and Roll Straightener.

POWER PRESS Ferracute #86 Double Crank Sgle. Action, S.S. Geared, 85 tons, 1¾" stroke, Bed area —61½" x 27⅝".

POWER PRESS — Bliss - Consolidated #163 - B Straight Side Dble. Crank Single Action, 45 tons, 6" stroke, Bed area—24" x 41", 15 h.p. 220 motor.

BUY with RECOURSE . . . . . .

No. 14 Buffalo Steel Billet Shear, 5½" round capacity.

No. 10 Buffalo Steel Bar Cutter, 3½" round capacity.

Artos Wire Stripper.

No. 60 Cameron Rotary Cap Thread Roller, M.D.

No. 10 Mitts & Merrill Airfluff Paper Shredder, M.D.

No. 32 Gorton Pantograph Engraving Machine with roll die att.

12"x12" Type DA Dings Magnetic Chip Separator.

No. 40-5 Minster S.S.—D.B.G. Press, 16" stroke.

No. 2G Brown & Sharpe H.S. Automatic Screw Machine, serial 13000 plus.

No. 4 LaPointe Broach, 50 ton capacity.

50 Ton Henry & Wright Dising Machine.

10"x18" Cincinnati Model EA Grinder, serial #SP2A1L-13.

No. 5-60 Cincinnati Hydromatic Production Mill.

No. 5 Loshbough Jordan B.G.—O.B.I. Punch Press, M.D., 4½" stroke.

No. 00 Brown & Sharpe H.S. Aut. Screw Machines, serials 12800 plus. (4)

1½" Conomatic Automatic Screw Machines, late. (3)

MACHINE TOOLS

TELEPHONE TAylor 9-8200
LAKE MACHINERY COMPANY
942 WEST LAKE STREET • CHICAGO 7, ILLINOIS

MACHINE TOOL BARGAINS

3—50 Ton DENISON Model AC-2 Hydraulic Presses, 18" str. 24" daylight electronic controls. Self-contained, used one year ..... Each $2,500.00

1—#70A HEALD Univ. Internal Grinder, 4 jaw chuck, 2 spindles, 3 motors $650.00

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1—20" OHIO Crank Shaper, drive all unit 5 HP Motor $550.00

1—10'x16 Ga. GEO. OHL Shear, extra set blades $1,150.00

1—#73-¾C BLISS Press, 2" str. 21x39 Bed, M.D. $1,250.00

1—#645A3 FELLOWS Gear Shaper, very excell. cond. $2,950.00

1—J & L Hartness Flat Turret Lathe ..$450.00

1—#1 BROWN & SHARPE Vertical Milling Machine $600.00

1—BENCHMASTER Vertical Mill, collets, like new $195.00

1—#1 WARNER & SWASEY Hand Turret Lathe, 1943 machine $275.00

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1—#7B FRAY All Angle Mill, with back geared head. New machine, never used $2,150.00

1—50 Ton LUCAS Forcing Straightening Press $450.00

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TRI-STATE PRODUCTS COMPANY
19 Seventeenth St., Toledo 2, Ohio
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No. 2 Cinn. Centerless Grinder.
Norton 6" x 18" Horz. Surface Grinder.
B & S No. 2 Surface Grinder.
Perkins No. 5508 O.B.I. Press. New.

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1 United Engineering & Foundry 156" x ½" power gap squaring shear $3,750.00
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FOR SALE — 1st Class Condition

LEBLOND LATHE, Size—25" swing over compound, 31" swing over bed, 96" Between Centers.
Motor—3/60/220-440 Volt, Age 3 years. Used approximately 150 hours.

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MINNEAPOLIS, MINN.

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AUTOMATICS
Brown & Sharpe, No. 00G.
Fay Automatic, 12"x81".

BORING MILLS
Giddings & Lewis No. 0, No. 25T.
Lucas No. 3L, horiz.
Heald #49 double spindle, #48A
Universal 3" horiz. equipped.
Bullard 24", 36", 42" VTL
King 72", 42" vertical

DRILLS AND RADIALS
Barnes No. 242, No. 5 Morse
Carlton 8'-19" column
Canedy-Otto 3'-9" col.
NATCO No. B225H multi-spindle
Cinci-Bickford 21" Box Col. S. S.
Sibley 24"-28", Power Feeds
Hamilton, Langelier, Hi-Speed.

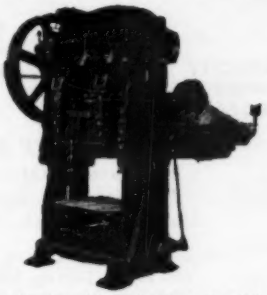
ENGRAVERS
Gorton No. 3U & 3L
Deckel GIL, 2 dimen.
Gorton Cutter Grinders 375-2, 266-6.

GEAR EQUIPMENT
Barber Colman No. 3 Precision
Fellows #7, 72, 712, 725, 7125, High Speed.
Fellows 645Y Spur & Spiral
Gleason #2 Surface Hardener.
Gleason 3" Spur Bevel Generator
Hamilton Hobber #00
Michigan, Gleason, Fellows Checkers.
Mikron Gear Hobber.

GRINDERS, MISCELANEOUS
Brown & Sharpe No. 5 cyl. 3" x 18", 3" x 12"
B. & S. Nos. 1, 2, 3 Univ.
B. & S. No. 13 Univ. & Tool.
Cinn. No. 2 Centerless Filmatic.
Cinn. 12 x 48" Filmatic Univ.
Cinn. #2 Univ. Tool & Cutter
Covel No. 91A Univ. T. & C.
Daizen Thread, latest
Gardner #226, 30" Disc.
Hanchett #228 Disc. Dbl. opposed w. M.D. Feed.
Heald 72A3 Sizematic Int. Centerless.
Jones & Lamson Thread, Univ. TG 53C.
K.O. Lee Tool & Cutter.
Landis, 10x24" type C Univ. No. 6 Thread, 10 x 36" angu.
Norton No. 2 Tool & Cutter, Hyd.
Oliver 510 Drill Grinder, Sellers 4G Drill Grinder

GRINDERS, SURFACE
Abrasive #3B, 8"x24" cap.
Abrasive No. 33, 24 Vert. 8x24.
Blanchard No. 11, 16" Mag. Chuck.
Blanchard #16A—30" Chuck
Blanchard #18-30" & 36" Chuck
G & L Hyd. #25, 6x18", #35, 8x24", #45, 12x24".
Hanchett Model 300, 13 x 48".
Heald #26A Rot. Surf 16" hyd.
Norton 6x18", and 10x36" Hyd.
Reid No. 2A P.F. MIB.
Reid No. 2C Motor Spdl. Hand Feed.
Thompson Hyd. 6 x 10 x 18", 6 x 12 x 18"

LATHES
Bradford 14"x6', G.H. Latest Sebastion 12"x4'
Hardinge Precision, 1" Collet Cap., Rivett. Precision.
Hendey 12" x 42" GH.



Bliss Double Crank Toggle Press No. 406—48"

Bliss #3½A Toggle Press Geared.
Bliss No. 304A, 306 Straight Side Presses.
Bliss 645E, 650 High Production Presses.
Henry & Wright 25 and 75 Ton Dieing Presses.

HYDRAULIC PRESSES

DOWN MOVING RAM, SELF CONTAINED

MANUFACTURER	TON CAP.	STR.	OPENING	PLATEN
Lake Erie	500	36"	68½"	35 x 36
H.P.M. Double Action	500	24"	30"	36 x 36
Watson Stillman Shaft Straightener	500	24"	57"	24" bed.
Denison	25/50	18"	23"	22 x 20
Hannifin	50	20"	30"	22 x 30
Southwark, D. A. Clamping Plate	125	30"	2' to 4'	84 x 30
Oilgear Shaft Straightener	35	8"	12"	84 x 11

DOWN MOVING RAM, WITHOUT POWER UNIT

Mesta	750	42"	80"	44 x 44
Chambersburg	300	10"	27"	22 x 36
Southwark	350	42"	70"	28 x 48
Southwark	550	23"	48½"	42 x 32

UP MOVING RAM PRESSES

Watson Stillman	100	8"	11½"	18 x 18
Southwark	600	20"	27" to 48"	34 x 24
Waterbury Farrel	800	6½"	28"	22 x 24
Birdsboro	800	20"	30" to 48"	40 x 32
Watson Stillman	300	12"	21"	24 x 20
Watson Stillman	300	12"	19"	20 x 20
HPM	180	15"	14½"	30 x 30
Dunning & Boschert Molding Press	300	12"	38"	24 x 32 Mold
Stokes Molding Press and Pump	50	7"	24"	20 x 12
Stokes Molding Press and Pump	150	8"	31"	24 x 23
Elmes—With Elec. Plates	50	4"	12"	18 x 18
Stewart Boling	85	10"	19"	20 x 20

WHEEL PRESSES

NILES — 600 ton 96" 500 ton — 48"; 300 ton — 48.

INJECTION MOLDERS

ACCUMULATORS

Mfr.	Size	Pounds
HPM	6" x 9'	2000
General Electric	15" x 11'	400
Watson Stillman (13 gal) Hydr. Pass.	42 x 9 x 48"	3000

Hendey G.H. 16x30", Rel. Att.
LeBlond Regal 16"x8½", 13"x24", 15"x30", 16"x48" T.A. 19"x48". T.A. 21"x60"
LeBlond Heavy duty 16"x30".
Lodge & Shipley 16 x 78" T.A., Collets, etc. and 20" x 54" equipped.
Lodge & Shipley 20"x54" G.H. 24 Spindle Speed latest
Monarch 10"x20" EE. 16"x54" T.A.
Monarch 12x30" Dble. Compound, swings 18", 12"x30" CRK.
South Bend Q.C.G., 13"x6', 10"x4'

MILLS, PRODUCTION
Brown & Sharpe, No. 000, 12, 21.
Cincinnati No. 1-12, 1-18, Mfg., 50-96 hydromatic
U. S. Multimiller, 1 & 2 Spindles.
Sundstrand 60 Rigidmills, Kent Owens IV.

MILLS, PLAIN AND UNIVERSAL
B. & S. No. 2B Pl., No. 2A Univ.
Cincinnati No. 3 Plain, 2M Plain
Cincinnati No. 2MH Univ., H.S.
Milwaukee 2HL, 2H Univ., H.S.
Milwaukee No. 2H Plain.
Van Norman Duplex, 6, 12, 20, 22L, 36.

MILLS, VERTICAL
Index, Jackson
Brown & Sharpe No. 2 Standard.
Cincinnati No. 4, Hi-Power.
Gorton No. 8D, 9-J Plain.
Morey No. 12M Profiler 2 sp.
Sipp MPS Jig Borer, & No. 42A
Fosdick #30 & 42A Jig Borers.
Pratt & Whitney #3 Jig Borer

PRESSES
Bliss No. 18, 19, 20, 21, OBI.
Bliss No. 304A, 4" Str. 28"x24" bed, #306 w. Air Cushion. S.S.
Bliss No. 645B, 650 Hi-Production, 58, 62, 62A, 162.
Bliss No. 4½ Double Action Cam Gen. flexible Screw Press.
Henry & Wright Dieing, 25, 75 Ton.
L & J #2, O.B.I. & V & O #01
Minster #5, 45 Ton OBI.
Reliance 45 Ton, O.B.I.
Z. & H. 30 Ton, O.B.I.
Stokes Tablet Presses, Model R & T, DD2, & Colton Tablet Presses

TURRET LATHES
Acme No. 4W, 6 W Bar and Chuck, Acme Fox.
Bardons & Oliver No. 3, 1⅛" cap., No. 5, Chuck.
Brown & Sharpe No. 1, 2F
Foster No. 3B.
Ginbolt No. 4, 5 Bar and Chuck, 2L, Saddle Type
Jones & Lamson #5 Univ. Preselector head.
Warner & Swasey No. 3, 5, Preselector, No. 4A 8" Cap.

MISCELLANEOUS
Band Saw: Tannewitz No. 36M.
Broach: American Horiz. Hyd. H-15-60.
Comparator: J & L 14" pedestal
Hacksaw: Marvel Nos. 6 and 6A, 9A Automatic Feed.
Marking Machine: Noble & Westbrook
Notching Press: Ferracute C82.
Pin Machine: Nilson.
Shaper: 24" Rockford Hyd. Heavy Duty.
Cinn. 24" Universal.
Sheldon 12" Brand New.
Honer: Micromatic Hydrohoner, Sunnen.
Keyseaters: Mitts & Merrill, Baker, Burr, Davis.
Rivet Hammers: Hi Speed, Chic. Pneumatic.
Toolmakers Microscope: Gaertner, Bausch & Lomb, Leitz
Router: #55 Oliver.
Tapper: Bakewell #1, #2
Haskins No. 3C, 9CAM.
Welders: Spot & Seam: Thompson, Taylor, Winfield.
Wrapping Roll: #½ Buffalo

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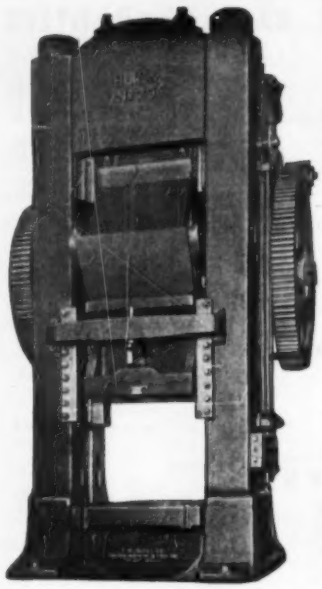

	667	668
CAPACITY	1200 TONS	1500 TONS
STROKE	5 "	6 "
DIE SPACE	33½ "	36½ "

DOUBLE BACK GEARED
Pneumatic Operated Friction Clutch
Equipped with Two Station Air Operated Dial Feed
—Bottom Lift Out—And Air Operated Pickoff

Also: 27 K Bliss Coining, 600 Ton
665 Toledo Coining, 800 Ton
78 Toledo Permanently inclined (2), 90 Ton
#2719 Hamilton Press, 800 Ton
#57 Toledo Straight side 135 Ton

JUST RECEIVED
#6 National Maxi-Press 2,000 Ton Capacity

EMERMAN MACHINERY CORP.

870 W. 120TH STREET — CHICAGO 43, ILLINOIS

GUARANTEED TOOLS

16"x60" PRATT & WHITNEY Toolroom Lathe
19"/38"x10' LeBLOND Sliding Bed Gap Lathe
20"x62" cc AMERICAN 12 Speed Timken Head Lathe, rapid traverse
24"x24' LODGE & SHIPLEY Lathe, 18' cc, taper, chucks, etc., MD
48"x30' NILES Heavy Duty Geared Head Engine Lathe, new 1939, taper, steady rests, MD
No. 2L GISHOLT Turret Lathe, preselector head, bar feed, complete collets, taper, threading attachments, chuck, 1942
4' HAMMOND Jackknife Radial, 1942, electric tapping attachment
36" BULLARD New Era Vertical Turret Lathe
100" SELLERS Vertical Boring Mill, two swivel heads, rapid traverse, New 1935
84" CONSOLIDATED COLBURN Vert. Boring Mill, 2 swivel heads, rapid traverse, AC—MD
No. 3 CINCINNATI Plain Mill, Vert. Head, 1941
No. 9A MARVEL Automatic Hacksaw, 10"x10" cap., bar feed, MD
No. 512 NIAGARA Straight Side Press, 280 tons, MD
24" GOULD & EBERHARDT Shaper, rapid traverse, power downfeed, factory motor drive
10" PRATT & WHITNEY Vertical Shaper, MD
10"—½" Pyramid Bending Rolls
No. 3½ BAKER Keyseater, cuts 4½" keyways, AC-MD

O'CONNELL MACHINERY CO.
1825 NIAGARA ST. BUFFALO 7, N.Y.

LATHE — Engine, Mackintosh-Hemphill 72"; 110"x30' centers (1943)
HYDROTEL — Cinc. Vert. Mill #28/60, 4 spindles, tracer (1942)
O.E.T. CRANES—(2) 10 Ton x 62' span, floor control (NEW)

BORING MILLS—D & H 3½" horiz., floor (Bargain Bullard V.T.L. 24", side head, Serial #11,165
DRILL PRESS—Minster #2D, heavy duty, 2½" cap.
GEAR GENERATOR—Ginsen #12, cap. 18" (1942)
MILLERS—Cinc. #3 Plain horiz. HI Power
Cinc. #3 Vertical HI Power
Newton Vertical 24"x42" rotary (Rebuilt)
PLANERS—N.B.P. 48"x48"x26'—4 Heads
Hamilton 36"x36"x10'—3 Heads, closed
PUNCH—Beatty #7—1¼" thru 1", 25" gap (1947)
ROLLS—BENDING—H. & J. 30"x¾", Pyr.
Southwark 15"x3", Pyr., Vertical
Angle-Bertsch, 3"x3"x⅝", Initial
SHAPER—G. & E. 24", back geared
SHEAR—Alligator (#2) 24" Blade, 3" Rds., etc.
THREAD MILL—Morey 12"x10' centers (1942)
PRESSES—Bliss #30—30 ton OBI, Adriance #4—40 ton OBI
Z & H #7—50 ton Percussion
Bliss #6—125 ton (1942), Bliss #78½—450 ton 18" stroke
HYD. PRESSES—375, 500, 675, 750, 3000 ton

KINGS COUNTY MACHINERY EXCHANGE
408 Atlantic Ave., Brooklyn 17, N.Y.
Dept. "A" TRiangle 5-5237

SNOW *means* FACTORY NEW *rebuilt* MACHINE TOOLS

One reason we're "snowed-under" with inquiries for equipment is because experienced machine tool men KNOW ABOUT SNOW—meaning they know how well SNOW rebuilds—to manufacturers' standards. With Snow-low prices, too, you CAN'T get a better buy than Snow Equipment.

TYPICAL SNOW VALUES

1—18"x8' AMERICAN Engine Lathe.
1—#3 BARDONS & OLIVER Turret Lathe, complete for bar and chucking, late type.
1—#2MH CINCINNATI Plain Miller.
1—#1 BAKEWELL Tapping Machine, late type.
1—Single Spindle PRATT & WHITNEY profiler, motor-driven.
#2 BROWN & SHARPE Surface Grinder, late type.
1—6"x30" type C Norton plain grinder, 1940.

Presses, Lathes, Grinders, new and used.

FERDINAND J. SNOW CO.
381 Broadway Westwood, N. J.
WEstwood 5-3271-2

Air Compressors 7—200 cu. ft., M.D.
Hammers, Air, 5-N Nazel, M.D.
Keyseaters, #1 and #2 Baker, M.D.
Lathes, Engine, 14"-36", M.D.
Pipe Threading Machines, 3 to 12", M.D.
Punch and Shear, #4 N & J, Double End, 1½"-1", Straightener, #1-A Sutton, 1½" Solid, 2" Tube Shears, Squaring 10 gauge to 1", M.D.
Slitters, Gang, 10"-40" Bliss & Yoder, M.D.

West Penn Machinery Company
1210 House Bldg. Pittsburgh, Pa.

MILL—KEARNEY & TRECKER 3K Plain Horizontal S/N 3-3292
STUB LATHE—SUNDSTRAND 10"x22" Type "D" with Air Cylinder and Air Chuck, S/N 10-462
KINGSBURY 5 Spindle Drill, #30 Heads, Table 11"x30½" M.D.N.A.

FOSTER MACHINERY SALES CO.
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22½" swing x 30" centers, serial #25002 with chuck, face plate, four way tool post, steady rest, round tool post, collets, etc.

PRICE $4,750.00
MFG. 1944 *EQUAL TO NEW*

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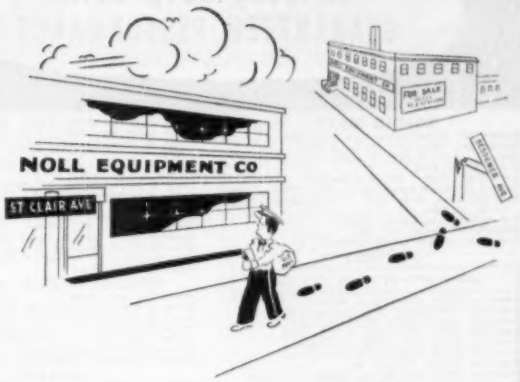

Acme-Gridley 2⅝" RA6-Spindle

Bullard 61" Vertical Boring Mill

Cincinnati 2-24 Mill

Van Norman #2SU Universal Mill

90% OF THE FOLLOWING MACHINES MANUFACTURED SINCE 1941

Goss & DeLeeuw 7½" 6-Spindle Automatic

Bullard 42" Vertical Boring Mill

Cleveland 2½" S.S. Model A

AUTOMATICS

Brown & Sharpe #26 Screw Machine
Cleveland 4" S.S. Model "A"
Cleveland 1⅝" S.S. Model "A"
Goss & DeLeeuw 6x6¾" 5-Spindle

BORING MILLS

Betts 6" Floor Type Horizontal
Cincinnati 44" Vertical Boring Mill
Niles 100" Vertical Boring Mill

DRILLS & RADIALS

Allen 6-Spindle Drill Press
American 4'11" Radial Drill
Avey #3 S.S. Drill Press
Baker #60 12-Spindle HG Drill
Edlund 4-Spindle Drill
Leland-Gifford 4-Spindle Drill Press
Minster "JR" #12 — 24" Drill

GRINDERS

Abrasive #33 Surface Grinder
Brown & Sharpe #1 Universal Grinder
Arter A1-12" Rotary Surface Grinder
Brown & Sharpe #22, 10x36" Cyl. Gr.
Bryant #5 Chucking Grinder
Cincinnati 6x18" Plain Cylindrical Gr.
Cincinnati #2 Centerless Grinder
Covel #15 Surface Grinder
Covel #91-A Univ. Tool & Cutter Gr.
Ex-Cell-O #31 Plain Thread Grinder
Hammond #6, Type B Carbide Tool Gr.
Hammond #10, D.E. Grinder
Heald #22-12" Rotary Surface Grinders
Heald #72-A Internal Grinders
Heald #81 Gagematic-Sizematic Grinders
Jones & Lamson 6"x36" Thread Grinder
Landis 6x30", Type "C" Plain Grinder
Landis 10 x 18" Grinder
Norton 10 x 36", 45° Cylindrical Gr.
Van Norman 20x48" Crankshaft-ReGrinder

LATHES

American 20" x 6' Engine Lathe
American 24" x 7' Engine Lathe
Bardons & Oliver #5 Turret Lathe
Betts-Bridgeford 36" x 8' Centers Lathe
Baye & Emmes 24" x 6' Lathe
Bradford 18" x 54" (8' Bed) Lathe
Gardner #3 Plain Polishing Lathe
Gisholt #5 Turret Lathe
Hendey 24" x 72" B.C. Lathe
Jones & Lamson #5 Turret Lathes
LeBlond 21" x 7' Engine Lathe
Lodge & Shipley #3A Duomatic Lathe
Lodge & Shipley 28" Lathe
Lodge & Shipley 12" x 30" Engine Lathe
Logan Model #200, 10x24" Lathe
Monarch 20" x 48" Engine Lathe
Monarch 14" x 30" Type "C" Tool Room Lathe
Porter Cable Carbo Lathe
Reed-Prentice 14x30" (6' Bed) Lathe
Warner & Swasey #3A Turret Lathe
Wicks 36 x 16' Bed Engine Lathe

MILLS

Cincinnati #2 Horizontal Mill
Cincinnati 1-18 Climb Mill
Cincinnati 2-18 Production Mills
Cincinnati 3-24 Hydromatic Mill
Cincinnati #3 Plain M.S.D.T. Horiz. Mill
Hardinge Vert. & Horiz. Mills
Index 22" x 8" Milling Machine
Kearney & Trecker #2 Special Mill
Kearney & Trecker #4K Horizontal Mill
Kent-Owens #1M Hand Mills
Lees-Bradner 12 x 30" Thread Mill
Products Model "M" Hand Mill

PRESSES

Bliss #30315 S.S. 35-Ton Punch Press
Ferracute 100 Ton S.S. Punch Press
HPM 100, and 150 Ton Hydraulic Presses
Standard #3 Screw Press (Arbor Press)
Minster 100-4-60, 32" x 60" Power Screw Press
Toledo #41 Horning & Wiring Press

SHAPERS

Fellows #6I Gear Shaper
Pratt & Whitney 6" Vertical Shaper
Smith & Mills 10" Horiz. Shapers

SAWS

Cochrane-Bly #55 Cold Saw
Do-All V-16 Band Saw
Higley 8" Cold Saw

MISCELLANEOUS

Airco #10 Pianograph
Ajax 2" Header (Upsetter)
Bakewell #1 Tapping Machine
Chicago #816, 8' 16 ga. Bending Brake
Cincinnati 2-48 Hydro. Duplex Vert. Broach
Detroit Tap Reconditioner
Elwell-Parker Boom Crane
Foster 4"x18" Superfinisher
Gleason #3 Spiral Bevel Gear Generators
Manville 150-Ton Header
Niles 90° Quartering Machine
Niagara 10', 3/16" Shear
Stoll, 10', 3/16" Squaring Shear
Taylor-Winfield Spot Welders
Telhurst Solid Curb 26" Chip Wringer

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BORING MILLS

Bullard 24", Spiral Drive, Vert. Late type
Bullard 24", "New Era" Vert. 1st class
King 34", Vert., 3 SCD, 12 speed
N B P 36-44, Vert.
Bullard 42", Vert. 2 hds on cross rail
Bullard 42" High speed Spiral Drive, Vert., Late
King 52" Heavy Duty Vert., 1 swivel hd. & 1 turret hd. on cross rail
P & H floor type, Horiz., 4" bar
Defiance #6, Horiz., 4½" bar
Mould #49, Single End Borematic

LATHES

LeBlond 27" x 90" centers, NEW 1942

American 14"x6', GH 8 speed, M.D.
American 16"x6', High Duty, Cullman Drive
American 16"x8', 3 SCD, Bowl head type
American 16"x8', High Duty, 3 SCD, DBG
American 16"x8', GH Turret on carriage
American 18"x8', 3 SCD, Bowl Head, BG
American 18"x10', 8 speed, M.D.
American 24"x8', GH, M.D., 8 speed, First Class
American 24"x12', GH, M.D., 12 speed, First Class
American 24"x14', GH, M.D., 8 speed, First Class
American 30"x13', GH, 12 speed, First Class
Immediate delivery
Boye & Emmes 16"x34", Motor in base, Late type
Boye & Emmes 18"x8', 3 SCD, DBG
Boye & Emmes 18" x 8', 3 SCD, DBG, Self Contained
Boye & Emmes 20"x8', 3 SCD, DBG
Hendy 14"x6', 3 SCD Self contained
Hendy 14"x8', Yoke type head, 4 SCD, Drive All
Hendy 14"x6', Model E. B. M. Geared Leg
Hendy 16"x6', 4 SCD, SBG, Yoke head
Hendy 18"x8', Cone head
LeBlond 14"x8', 4 SCD, SBG, Drive All
LeBlond 17"x8', Heavy Duty, SPD, 12 speed
LeBlond 17"x8', 3 SCD, DBG
LeBlond 21"x8', 3 SCD, DBG
LeBlond 24"x10', 3 SCD
LeBlond 25"x12', Heavy Duty, SPD
Lodge & Shipley 14"x30" centers, M.D., 12 speed
Lodge & Shipley 14"x8', 5 SCD
Lodge & Shipley 16"x6', 3 SCD, DBG
Lodge & Shipley 16"x30" centers, GH, 12 speed, Late type
Lodge & Shipley 16"x8', Selective Geared Head, 12 speed
Lodge & Shipley 18"x8', GH, M.D.
Lodge & Shipley 18"x8', 5 SCD, SBG
Lodge & Shipley 18"x8', 3 SCD, DBG
Lodge & Shipley 18"x8', Selective Geared Head, SPD
Lodge & Shipley 18"x8', Bowl head type, 3 SCD, DBG
Lodge & Shipley 20"x8', GH, SPD
Lodge & Shipley 20"x10', Selective Geared Head, 12 speed
Lodge & Shipley 27"x10', Patent Head, 18 speed
Monarch 14"x6', 3 SCD, DBG
Monarch 16"x34" centers, Model "CW"
Monarch 16"x6', Motor on leg type, 8 speed
Niles Tiemeaver 30"x10' centers, Double Wall Apron
Sebastian 16"x8', 4 SCD

GEAR CUTTERS & HOBBERS

Adams #3 Gear Hobber
Brown & Sharpe #3—36" Gear Cutter, SPD
Gould & Eberhardt 36-8 Vert. Gear Cutter
Brown & Sharpe #5—28" Gear Cutter
Fellows #015 Helical Gear Shaper
Gleason 3" Bevel Gear Generator
Gleason 6" Straight Bevel Gear Generator

MILLERS

Cincinnati #0-8 Vert. Mill, with Power Rotary Table—LATE TYPE

Cincinnati 3-36 Plain Hydromatic, First Class
Ohio 40" Tilted Rotary Miller
Van Norman #118 Bed Type, Production Miller
Van Norman #36 Ram Type, Plain Miller, Late
Cincinnati #3 High Power Rectangular Overarm, Plain Miller
Cincinnati #3 Plain Horiz. Miller
Brown & Sharpe #2B Plain Miller
Kempsmith #2 Plain Miller, 4 SCD, SBG
Brown & Sharpe #12, Plain Miller
Brown & Sharpe #2I, Plain Miller, Obie Overarm
Rockford #2 Plain, bank geared high powered
Van Norman #2B, Plain Miller, LATE TYPE
Milwaukee #3-B Plain Miller DRO
Brown & Sharpe #3B Heavy Plain Miller
Cincinnati #3B Univ. Hori. overarm, First class
Milwaukee #2B Universal Miller, SPD, DRO
Cincinnati #3 Universal High Power Miller
Brown & Sharpe #3A Universal Miller
Cincinnati #4 Universal Miller
Brown & Sharpe #4A, Universal Miller, all geared feeds, first class
Newton Heavy Duty Vert., Hydraulic, NEW 1944
Brown & Sharpe #2 Vertical Miller
Cincinnati #4 Vert. High Power Miller, first class

MISCELLANEOUS

Cincinnati #2 Centerless Grinder—Late type
Landis 26"x144" External Grinder—Late type
Racine 20 x 20 Shear cut Saw — Late type

GUARANTEED MACHINERY

Cincinnati Machinery Co., Inc.
219 East Second Street
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We Buy—We Sell COLLETS

R. A. 6 Gridley Automatic — 1", 1¼", 1⅝", 2", 2¼" & 2⅝". 1 x 5 New Britain. Collets for Gridley Model F, ¾, ⅞, 1¼, 1⅜, 1½, 2¼, 2⅜, 3¼, 4¼ Automatic Machine. Extra large stock of 2⅜, R.A. 6 Gridley parts and collets. We have a large stock of used collets Acme 515, 51, 52, 53 54, 55 and 56, Acme Gridley, Cleveland, Cone, Foster, No. 1, 2, 4, and No. 6 Warner & Swasey, Bardons & Oliver, Brown & Sharpe, Garvin and Model 61 New Britains.

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SPECIAL—Large Stock of Collets, feed fingers and parts for late type 1" and 1⅝" Greenlee Automatic.

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WOODWARD 48x48x12' Double Housing, two rail heads, one side head, AC belted motor drive
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GRAY, 30x30x10' Double Housing, two rail heads, belt driven
GRAY, 42x30x10' Double Housing, Widened Pattern type, two rail heads, one side head
FLATHER, 30x36x10' Double Housing, Motor driven, two rail heads
GRAY, 24x24x8' Double Housing, motor driven, single head on cross rail

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All sizes, any quantity 25% of List

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McDONALD
USED MACHINERY

Colburn 62" Hvy. Duty Vertical Boring Mill
G & L and Universal 3" Bar Horiz. Boring Mills
Campbell 6" Cap. M.D. Abrasive Cut-Off Mach.
Mollins 6-Sp. Hole Hog Drill, Barnes 4-Sp.
20" All Grd. Cored Back Drill
Cin-Bick 3' & Morris 3½" Arm Radial Drills
Do-All 8 x 24" Horiz. Sp. Hyd. Surface Grinder
Blanchard M.D. Vert. Sp. Surface Grinder 20" chuck
L & S 20" x 8', 18" x 12', 20" x 10', 28" x 12'
Monarch 20" x 8', Amer. 20" x 12' grd. hd. 4-4-8, m.d. Engine Lathes
B & S Nos. 2-B & 3-B, Cin. No. 3 Mil, No. 2-B & 3-B, Cin. No. 3 LeBlond No. 4, Grd. Hd. Plain Millers
B & S No. 2-A & 3-A, Mil. No. 2-B, Cin. No. 1-M, Cin. No. 2 Grd. Hd. Univ. Millers
Avey 2-Spindle MA8 Drill Press late.
Niagara 12' Power Square Shear, 10-Ga. 18" gap late

Cin. #3 Vert. Miller Late
Cin. 24" M.D. Univ. Shaper.
Cleveland 48" x 12' Table Open-side Planer, 3 Hds.

McDONALD MACHINERY CO.
1531-35 No. B'way., St. Louis 6, Mo.

No. 25T G. & L. 2½" table Hor. Mill, 1942
3" Univ. Table Mill, 40" vert., 72" hor., '43
4" Univ. Table Mill, 40" vert. 96" hor., '43
36" & 42" Kings Side Hd. Vert. Mills, '43
Nos. 1A & 3 W. & S. Turrets, bar & chuck
Nos. 3 2MH Cinci. Fl. Dial Millers, late
Nos. 3K & 3H K. T. Pl. Dial Millers, late
No. 36 Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2416 Keller Duplicator, 3 dim., 3 spin.
No. 9J Gorton Elec. Duplicator, 1944.
Gear Cutter, No. 13 B. & S., spur & bevel
30"x120" cen. Axelson Lathe, T.A.
30"x120" Hanchett Pianto Surface Grinder
No. 2 Stand. K. & T. Univ. Miller, Timken
Gear Cutter, 3-36" B. & S. Spur, Late
12"x48" Hanchett Vert. Spin. Surface Grinder
96"x96"x24' N.B.P. Planer
6' 17" col. Carlton Radial, M on arm
14"x54" cen. Monarch, T.A., 1945.

BENNETT MACHINERY CO.
30 Church St., New York 7, N. Y.

EXCEPTIONAL MACHINE

NORTON 26"x2" TYPE C "HI-SWING" GRINDER built 1944, but *never used;* equipped for cylindrical, crankshaft and internal grinding. Actual swing 26-7/16", Length between centers 72". Motors 3/-60/220-440V.

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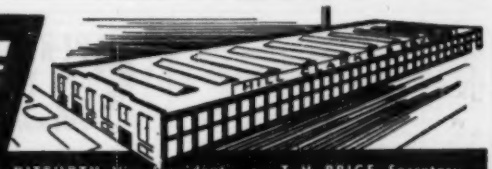

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AUTOMATICS
No. 49 New Britain, 4 Spdl. Chucker
Model A 3¼" Cleveland (1942)

DRILLS
No. 150 Baker (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 200—24" Defiance #5 Taper (1943)
No. 1-LMS Leland-Gifford (1942)
No. 2-LMS Leland-Gifford (1942)
No. 4BL Natco 36 Spdl. (1943)
3'-10" American Triple Purpose, M.D.
3'-10" Foodick
5' Western Heavy (1942)
6'-17" Foodick Hyd. Economax Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 1K H8 Gould & Eberhardt
No. 12 Gleason Bevel Gear Generator
72" Cincinnati Gear Cutter
No. 3 Barber-Colman Hob Sharpener

BORING MACHINES
No. 31 Lucas 3" bar, M.D.
No. 32 Giddings & Lewis, 3½" Bar
No. 2 Lambert 4" bar
No. 48-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
24" Bullard
42" Bullard New Era
60" Colburn, M.D.
72" Niles-Bement-Pond
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
4"x18" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x36" Landis Type C hydraulic (1942)
Norton Motorized Grinders ranging from 6"x18" to 18"x36"
No. 3 Abrasive Surface Gdr.
No. 34 Abrasive Surface Grinder (1943)
No. 11-16 Blanchard
No. 36-A Hanchett Rotary Surf. (1942)
No. 72-A-3 Heald Internal (1942)
No. 72-A-5 Heald Internal (1942)
No. 16—38 Bryant Internal Gdr.

LATHES
18"x6' American, Gdr. Head, M.D.
18"x8' American Gd. Hd.
36"x16' Belts—Bridgeford Grd. Head
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model B (1943)
10"x22" Sundstrand, Model AA (1943)
20" Fay Automatics (1942)
Model R-14 Seneca Falls Lo-Swing
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1942)
No. 5 Bardons & Oliver (1942)
No. 2-A Warner & Swasey (1941)
No. 1-H, 6" Libby
No. 1-H Libby, Extra Long Bed (1942)

MILLING MACHINES
No. 3B Milwaukee Plain
No. 3 Cincinnati Universal
No. 2M Cincinnati Vert. (1941)
No. 2 Cincinnati Vertical
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cincinnati Mig. (1942)
No. 2—18" Cincinnati Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
No. 2-24 Cincinnati
No. 4-48 Cincinnati Hyd. Tracer (1943)
No. 34-48 Cincinnati Hyd. Duplex (1943)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 56-72 Cincinnati Hydromatic
No. 58-90 Cincinnati Hydromatic
4½"x12" Pratt & Whit., Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1943)
12"x24" H.T. Lees-Bradner (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x24"x12' Ingersoll Duplex Miller (1946)
No. 10 Ingersoll 72"x8' Travelling Col. Face Millers (1942)
No. 28-60 Cincinnati Hydrotel

MISCELLANEOUS
18" Dill Slotter
Micromatic Vertical & Horisontal Hydrohoners

PLANERS
36"x36"x12' Cincinnati
36"x36"x18' Gray Maxi Service, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads
144"x76"x48' Liberty Openside Planer

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UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 2—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 16"x36" Surface 13"x63", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x8', 8', 10'—10"x6', 8', 10'—16"x6', 8', 10'—20"x10'—all some drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x6', 24"x8', 26"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars; measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. Now Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.

P. O. Box 88 Columbus 16, Ohio

LATE MODEL MACHINE TOOLS . .

AUTOMATICS
16" Bullard Mult-Au-Matic, 6 Spdl. 1941.
1⅝" Greenlee, 6 spindle. 1942.

BOLT MACHINES
No. 500C Manville Thread Roller. Latest.
No. 250C Manville Header, S8861. Latest.

BORING MACHINES
62" King Vertical. 1942.
47A & 48A Heald Single End. 1943.
No. 46B Heald Single End. 1940.

DRILLS, RADIAL
5' 15" Cincinnati-Bickford. 1942.
6' 12" American Hole Wizard. 1941.

GEAR EQUIPMENT
No. 6 Gleason Ravacycle. 1941.
No. 6 & 17 Gleason Testers. 1943.
6" Red Ring Internal Shaver. Late.
No. GCL Red Ring Shaver. 1942.
No. 645A3, 615A & 61A Fellows. 1944.
No. 712 & 72 Fellows Shaper. 1943.
Vinco Spline & Gear Grinder 1942.
Red Ring Univ. Checker.

GRINDERS, CYLINDRICAL
25" x 48" Landis, Crankshaft. Like New.
16" x 36" Cincinnati Plain. 1942.
12" x 30" Landis Univ. 1941.
10" x 72" Landis Plain. 1942.
10" x 13" Norton Plain. 1942.

GRINDERS, INTERNAL
No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 10A32 Bryant. Latest.

GRINDERS, SURFACE
No. 22 & 25A Hoult Rotary. 1943.
6" x 18" Norton Vertical Hyd. 1941.

LATHES, ENGINE
45" x 192" Arelson. 1942.
36" x 12' Lellkind. 1942.
27" x 96" Lellkind. 1942.
14" x 30" Bradford. 1942.

LATHES, PRODUCTION
No. 3A L&S "Duomatic". 1943.
8" x 108" Lo-Swing Semi. Auto. 1942.
Model 8 & 10 Sundstrand. 1942.
14" x 42" Monarch "Magna-Matic". 1941.

LATHES, TURRET
42" x 36" Bullard Vertical. 1943.
No. 1 & 8¼" x 24" Acme Univ. 1943.
No. 2 & 4 Warner & Swasey. 1942.
No. 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN
No. 3B Brown & Sharpe. 1941.
No. 5 Cincinnati. 1943.
No. 36 Van Norman. 1942.
No. 2B Van Norman. 1942.
No. 2HL Milwaukee. 1942.

MILLS, PRODUCTION
No. 2-24 Cin., Plain and R. & F. 1943.
No. 1-14 & 2-20 Kent Owens 1942.
M-18 Kearney & Trecker. 1943.
No. 1224 Kearney & Trecker. 1942.
No. 3-36 Cincinnati Duplex, R. & F. 1942.
No. 3-36 Cincinnati Hydromatic. 1942.
No. 1-18, 2-18 & 3-24 Cincinnati. 1942.

MILLS, THREAD
12" x 54" Lees Bradner. 1943.
6" x 36" Lees Bradner. 1942.
4" x 9" Hanson Whitney. 1942.

MILLS, UNIVERSAL
No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No 2SU Van Norman 1942.

MILLS, VERTICAL
No. 2K & 3H Milwaukee. 1942.
No. 2 Cincinnati. 1942.
No 1 Cleveland 1942.

PRESSES
100 Ton Baldwin Southwark, Hyd. 1944.
50 Ton Denison, Hyd., Str. 1942.

SHAPERS & PLANERS
48"x48"x16' Cin "Hypro". 1943.
20" Cincinnati Plain. Late.
25" Smith & Mills Univ. 1945.

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1⅝" Greenlee 6 spindle.
1⅞" Conomatic 8 spindle.
2"x18" Cleveland Model B.
4⅝" Conomatic 4 spindle.
No. 16 New Britain 6 spindle chucker.
No. 454 New Britain 4 spindle chucker.
No. 5 DE 2 Potter & Johnston chucker.
8" Bullard Multomatic 6 station.
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14"x19" Fay.
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3½" No. 32 Lucas horizontal.
3½" No. 32 Giddings & Lewis horizontal.
3" No. 31 Lucas horizontal.
3" No. 3A Universal horizontal.
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No. 27 Heald Boromatic.
No. 12 B Ex-Cell-O.
No. DB 2112 Ex-Cell-O.
No. 1212A Ex-Cell-O 4 spindle.
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Vernim vertical miller or jig borer.
Munson double end horizontal.
No. 4 HH Baker 2 way horizontal.

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16"x5' Sebastian
16"x10' American.
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No. 7 Bardons & Oliver.
Nos. 3, 4, 5 3AL & 28" Gisholt.
No. 4 Midland.
No. 6.2 Denver.
24" & 36" Bullard vertical.
3"x36" & 4"x34" Jones & Lamson.
Nos. 2G & 3 Morey.
No. 5 Foster.

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No. 3 Cincinnati universal.
No. 3 Van Norman Duplex.
Nos. 2AS & 3B Milwaukee plain.
No. 3 Cincinnati MSDT plain.
No. 3 Ohio plain.
Nos. 2H & 3H Kearney Trecker vertical.
Nos. 2, 3 & 4 Cincinnati dial vertical.
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No. 3 Kempsmith Maximill vert.
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BROACH, 10T, 36" stroke Colonial surf.
DRILLS, 121, 217, 314A, 315, 30H Baker.
GEAR HOBBERS, 8H, 12H, 16HS, 18H G&E
GRINDER, 12"x36" Cincinnati univ.
HAMMER, No. 5N Nazel air.
HONER, No. 307 Barnes.
LAPPER, No. 26F Norton Hyprolap.
PROFILER, No. 12B Pratt & Whitney.
PRESS, 1000 ton Baldwin hydraulic
TAPPER, Baush radial arm.
TAPPER, No. 1 Bakewell.
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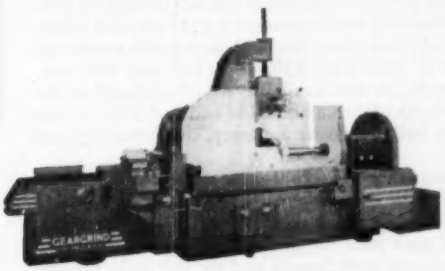

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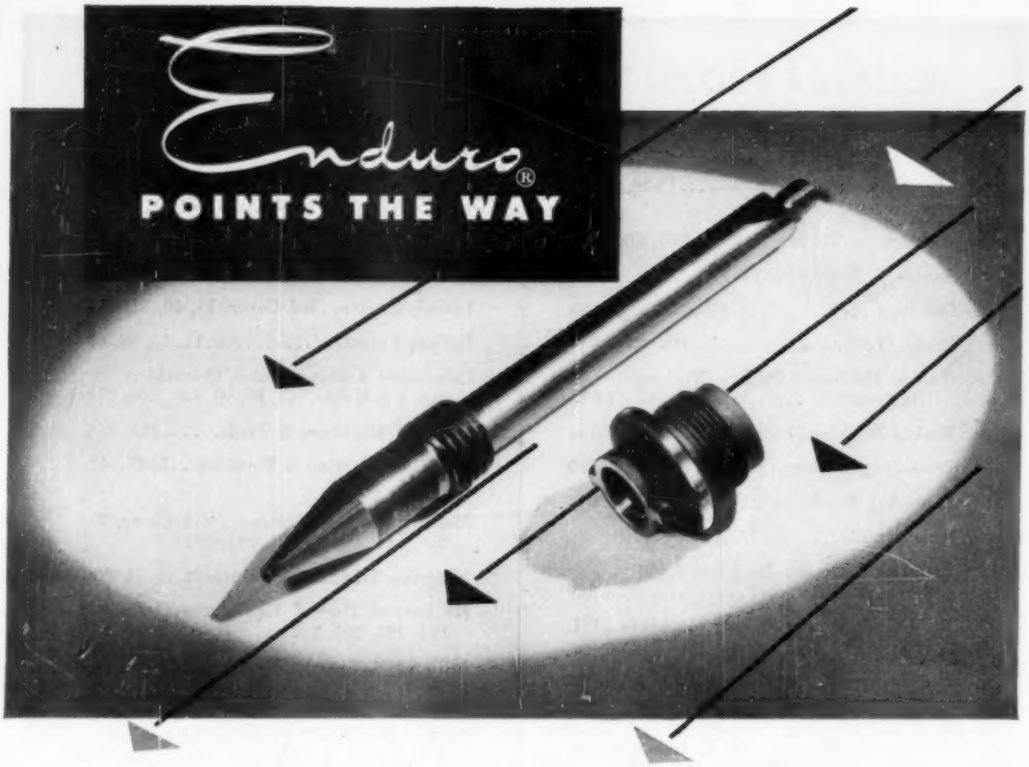

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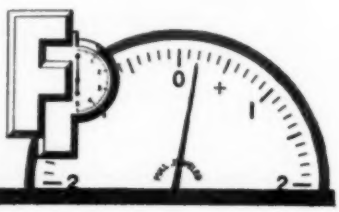

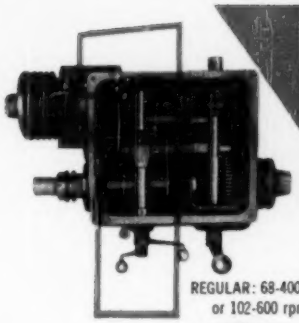

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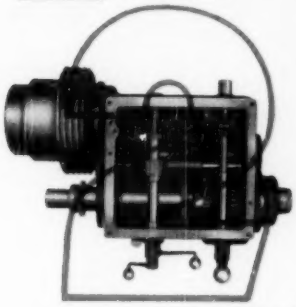

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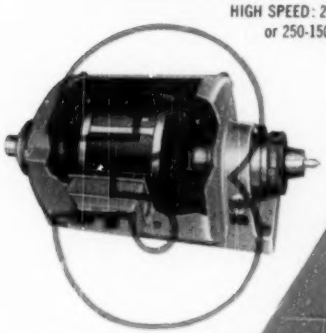

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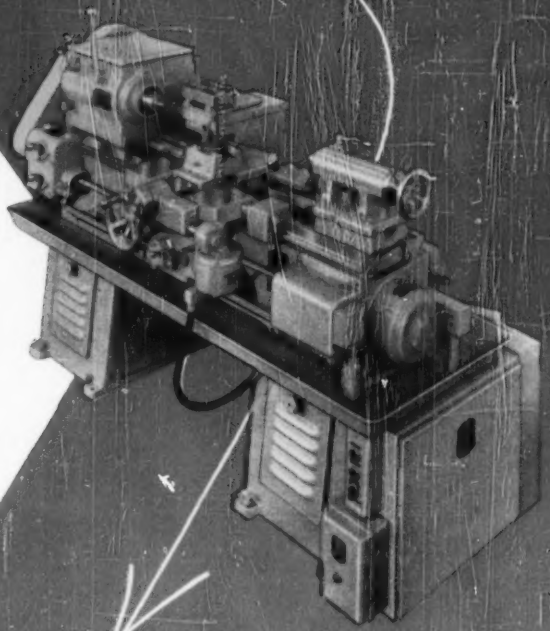

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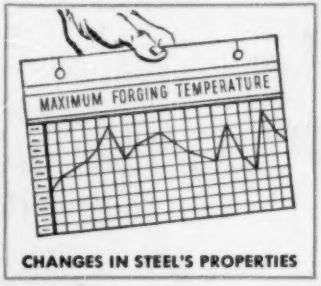

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